INSTRUCTION MANUAL

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MODEL 1018A

LOG/LIN RF PEAK POWER METER

MODEL 1018A

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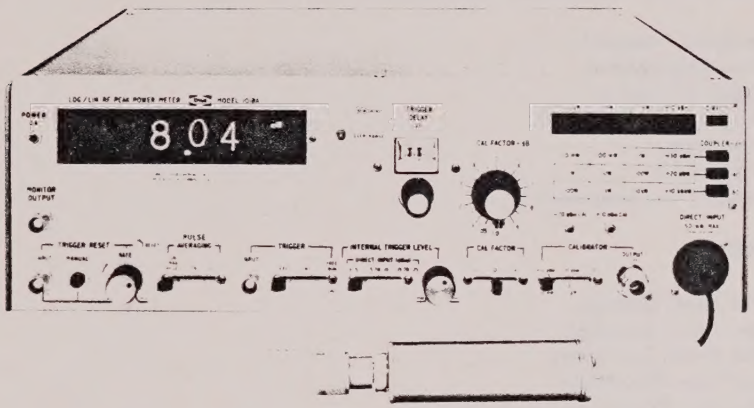

LOG/LIN RF PEAK POWER METER

MODEL 1018A

SERIAL NUMBER _____

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SECTION 1

GENERAL INFORMATION

1.1 PACIFIC MEASUREMENTS MODEL 1018A LOG/LIN RF PEAK POWER METER

The Model 1018A measures RF pulses with widths as short as 0.25 μs. The instrument measures signals of amplitude between 10 μW (-20 dBm) and 10 mW (+10 dBm). The unit employs a 50Ω matched coaxial RF detector to make the measurement, and its frequency range extends from 100 MHz to 12.4 GHz. The instrument responds to each pulse individually; thus it is not sensitive to pulse width, repetition rate, duty factor or pulse shape. The pulse is detected, sampled, held and the data stored digitally each time the unit is triggered. The data is displayed on a 3-digit (plus overrange) digital display.

The instrument operates by sampling the detected video pulse from the detector. The sampling gate will automatically close upon the arrival of an RF pulse when on internal trigger. The point of sampling may be delayed up to 100 μs from the leading edge of the pulse using the trigger delay control. Similarly, if external triggering is used the sampling point may be delayed up to 100 μs from the arrival of the external trigger. Thus, it is possible to adjust the delay so that the peak of each pulse is sampled. Alternatively, a plot of pulse amplitude vs. time may be obtained by taking data at points of successively greater delay. A monitor output supplies the signal corresponding to the detected RF power as amplified by the trigger level amplifier. This signal is useful for displaying the pulse on an oscilloscope and gives the operator an indication of the approximate pulse shape. At high trigger reset rates a video pip is added to the waveform at the monitor output so that the point of measurement may be observed on an oscilloscope. Built-in self calibration is provided.

1.2 MODEL 1018A PERFORMANCE SPECIFICATIONS

The specifications of the Model 1018A are given in Table 1-1.

TABLE 1-1

RF PERFORMANCE	
Operating Frequency Range:	100 MHz to 12.4 GHz, minimum.
RF Power Measurement Range:	Direct, 10 microwatts to 10 milliwatts minimum; with external 20, 40 and 60 dB couplers (not supplied), 10 milliwatts to 10 kilowatts minimum.
RF Power Rating:	50 milliwatts maximum (direct). Peak or CW
RF Input Impedance:	Resistive, 50 ohms nominal.
RF Input VSWR:	100 MHz to 4.5 GHz, 1.2 maximum; 4.5 to 7 GHz, 1.35 maximum; 7 to 12.4 GHz, 1.50 maximum.
RF Pulse Width Measurement Range:	0.25 microseconds to CW on internal trigger. 0.20 microseconds to CW on external trigger.
RF Pulse Shape:	The unit will measure the peak pulse power in rectangular and Gaussian shaped pulses with a minimum duration of 1 microsecond and at selected points within the pulses with equal accuracy.
RF Coded Pulse Measurement:	The unit will measure the peak pulse power of selected pulses within a position-coded pulse train whose duration is less than 100 microseconds.

(Continued)

TABLE 1-1 SPECIFICATIONS (Contd)

RF Power Measurement Characteristics:	MAXIMUM ALLOWABLE			
	100 MHz to 4.5 GHz	950 MHz to 1250 MHz	100 MHz to 8 GHz	100 MHz to 12.4 GHz
Frequency Response	± 3%	± 1%	± 7%	± 12%
Accumulated Error (linear mode)	± (6% of reading + 1 count)		± (9% of reading + 1 count)	± (15% of reading + 1 count)
Accumulated Error (logarithmic mode)	± 0.3 dB	± 0.3 dB	± 0.5 dB	± 0.8 dB

DISPLAY

Readout Type: In-line digital, $3\frac{1}{2}$ digits, uncertainty ± 1 count maximum.

Full Scale Ranges:

Linear Mode: Direct, 100 microwatts, 1 milliwatt and 10 milliwatts. With directional couplers (not supplied): 20 dB, 10 milliwatts, 100 milliwatts and 1 watt; 40 dB, 1 watt, 10 watts, 100 watts; 60 dB, 100 watts, 1 kilowatt and 10 kilowatts. The scale markings and unit enunciator correspond to the power measurement ranges.

Logarithmic Mode: 30 dB range with direct reading in dBm, dBW and dB KW.

Overrange: 100 percent between ranges (i.e., between 100 µW and 1 mW and 1 mW and 10 mW) and 5% on top range (i.e., 10 mW) linear mode. An overrange light indicates when in an overrange condition.

Display Rate: Internally controlled, continuously adjustable for a non-blinking display; internally and externally synchronized, 0 to 500 readings per second minimum. Display resets to zero approximately 5 seconds after input signal has been removed.

Residual Noise: Less than 1 dB peak to peak at -20 dBm (10 µW) and less than 0.2 dB peak to peak above -15 dBm (31.6 µW). With pulse averaging less than 0.2 percent of full scale (Linear Mode).

CONTROLS AND OPERATION

Internal Calibrator: An internal, stabilized CW oscillator is provided for use in standardizing or verifying the RF power measurement calibration of the unit.

Output Connector: Precision stainless steel. Type N female conforming to Figure 1-1.

Output Level: Selectable by a front panel switch: off; 10 microwatts, ± 2.5% maximum; 10 milliwatts, ± 1.5% maximum.

(Continued)

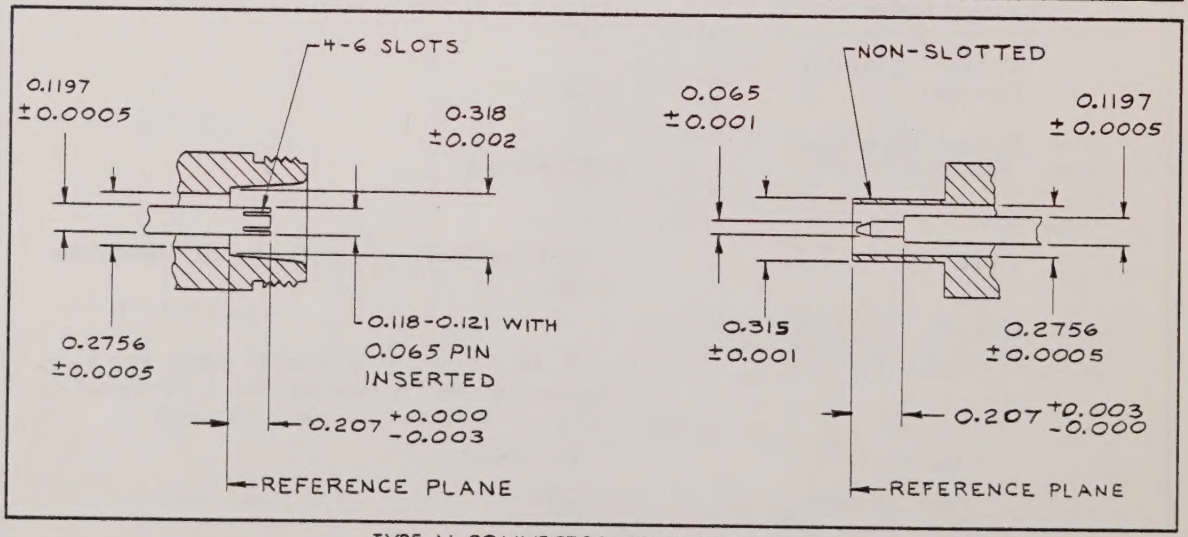
TABLE 1-1 SPECIFICATIONS (Contd)

Residual Signals	All spurious, harmonic and nonharmonic signals are at least 50 dB below the level of the fundamental signal.
RF Output Impedance	Resistive, 50 ohms nominal.
RF Output VSWR	1.06 maximum (30 dB return loss) at calibrator frequency.
Calibrator Adjustment	A recessed rear panel screwdriver adjustment is provided to adjust the level of the internal calibrator. The resolution of the adjustment is better than 0.1% and has a range of at least 10%.
Calibrator Stability	The long-term (6 months) drift of the calibrator output is better than ± 1%.
Calibration Adjustment	Recessed screwdriver adjustments are provided on the front panel to set the digital display to indicate the internal calibrator output levels.
Frequency	105 MHz nominal.
Calibration Factor:	A front panel control is provided to correct the power meter reading, in both linear and logarithmic modes, for deviations of external directional couplers and attenuators from their nominal values. The control is marked in dB.
Correction Range	± 1.0 dB.
Increment	0.05 dB.
Trigger Selector:	A front panel control is provided to select either internal, external or free-run operation.
External Trigger Sensitivity	+ 1.5 volt minimum for pulses with widths greater than 0.2 microseconds and rise-times less than 1 microsecond. ± 10 volts maximum.
Internal Trigger Sensitivity	-25 to + 10 dBm in three ranges.
External Trigger Input Connector	BNC jack.
External Trigger Input Impedance	1 KΩ minimum.
Trigger Reset:	
Manual	A front panel pushbutton is provided for resetting the trigger.
External	
Sensitivity	+1.5 volt minimum for pulse widths greater than 0.2 microseconds and rise-times less than 1 microsecond. ±10 volts maximum.
Impedance	1 kΩ minimum.
Input Connector	BNC jack.

(Continued)

TABLE 1-1 SPECIFICATIONS (Contd)

Trigger Delay	A front panel, continuously variable control calibrated in microseconds is provided to delay the point in time where the pulse power is being measured; range, zero to 100 microseconds minimum; linearity, ± 2% of full range; maximum delay at zero setting, 0.2 microseconds.
Monitor:	A front panel connector is provided for monitoring the detected RF pulse envelope.
Level	Continuously adjustable by a front panel control; output, 0.5 volts peak-to-peak minimum with -20 dBm RF input.
Risetime	0.25 microseconds at input RF levels between 1 and 10 milliwatts.
Overshoot	5% maximum.
Marker	A marker is provided on the detected pulse waveform coincident with the peak pulse power measurement point.
Connector	BNC jack.
MISCELLANEOUS REQUIREMENTS	
Configuration:	The RF input head may be easily removed from the main unit for remote sensing of RF power at distances up to 4 feet from the main unit. The input head utilizes a male stainless-steel Type N connector, conforming to Figure 1-1, and is 5.12 inches in length, 1.17 inches in diameter and 8 ounces in weight.
Temperature Range:	Operating, 15°C to 45°C; nonoperating, -20°C to 71°C.
Size:	19" wide, 5½ high, 13" deep.
Weight:	20 lbs. (shipping 28 lbs).
Supply Power:	115 volts ± 10% or 230 volts ± 10% at frequencies between 50 and 400 Hz. 50 VA maximum.



TYPE N CONNECTOR CONFIGURATION
FIGURE 1-1

SECTION 2

INITIAL INSTRUCTIONS

2.1 RECEIVING INSPECTION

Unpack the instrument carefully and check for any obvious shipment damage. If damage is evident, file a claim against the carrier. The carrier will normally supply appropriate forms.

2.2 POWER REQUIREMENTS

The unit is connected at the factory for operation from 105 volts to 125 volts ac at 50 to 400 Hz. The unit may be adjusted for operation from 210 volts to 250 volts ac if required. Conversion from one voltage to another may be made by changing the position of a rear panel switch. In either position, the switch exposes numbers indicating the correct operating line voltage. To change the position of the switch, insert a small screwdriver in the slot provided and push the switch in the desired direction.

2.3 CHASSIS GROUNDING

The instrument is supplied with a three-conductor NEMA type power cord. The instrument will be properly grounded if the plug is connected into a properly installed three-prong receptacle. If a three-prong to two-prong adapter is used, be sure that the pigtail lead of the adapter is grounded.

WARNING

FAILURE TO PROPERLY GROUND THE INSTRUMENT CAN ALLOW DANGEROUS VOLTAGES TO BUILD UP ON THE CHASSIS WHICH COULD BECOME DANGEROUS TO OPERATING PERSONNEL.

2.4 RETURNING THE INSTRUMENT

If it is necessary to return the instrument to Pacific Measurements, authorization must first be obtained from our Sales Department or local representative. Before packaging, the instrument should be wrapped in a protective material such as polyethylene to protect it from marring. If you do not have the original shipping container, wrap the instrument in a large quantity of protective padding material such as foam or hair flex and use a rugged cardboard or wooden container as a packing carton. Pack the instrument firmly so that it will not move around in the container. A letter containing all pertinent information should be included with the package unless you have already sent such a letter to our Sales Department.

2.5 ACCESSORIES

Qty.	Part No.	Description
1	12356	3 Conductor Power Cord
1	-----	Instruction Manual

2.6 CERTIFICATION

Pacific Measurements Incorporated certifies that this instrument was thoroughly tested and inspected and found to meet all its published specifications when it was shipped from the factory. Pacific Measurements Incorporated further certifies that its calibration measurements are traceable to the U.S. National Bureau of Standards to the extent allowed by the Bureau's calibration facility.

2.7 WARRANTY AND ASSISTANCE

All Pacific Measurements products are warranted against defects in materials and workmanship. This warranty applies for one year from date of delivery or, in the case of certain major components listed in the instruction manual, for the specified period. Pacific Measurements Incorporated will repair or replace products which prove to be defective during the warranty period free of charge. No other warranty is expressed or implied. We are not liable for consequential damages.

For assistance contact your nearest Pacific Measurements franchised representative office or the factory in Palo Alto, California.

SECTION 3

OPERATION

3.1 FRONT PANEL CONTROLS

In addition to the power switch, the following controls are on the front panel of the instrument:

a. RANGE PUSHBUTTONS. The four mechanically interlocked pushbuttons arrayed in a horizontal line at the upper right corner of the panel control the operating range of the instrument. The three buttons to the left select linear operation; the labeling above the button corresponds to the full scale range of the display. The right-hand button selects a logarithmic display mode, with a full-scale range of +10 dBm (when the coupler selector is in the DIRECT mode).

b. COUPLER SELECTOR PUSHBUTTONS. The four mechanically interlocked buttons correct the display to compensate for the signal loss when using directional couplers to monitor power in a system. The unit can be compensated for couplers with 20, 40 or 60 dB loss. The coupler loss corresponding to each button is marked immediately to the right of the button. Full-scale readings are read from the matrix under the range buttons.

c. CAL FACTOR SWITCHES. The CAL FACTOR controls permit the instrument's reading to be corrected for a detector calibration factor differing from unity, or coupler losses differing from the nominal value by up to 1.00 dB. The lower three-position switch, marked - 0 +, selects whether the corrections will be subtracted from or added to the reading, or if none will be applied. In the - position corrections will be subtracted, in the + position they will be added. The top rotary switch selects the magnitude of the correction in .05 dB increments. It is inactive when the lower switch is set to 0. Set the lower switch to 0 when calibrating the instrument.

d. CALIBRATOR SWITCH. This three-position lever switch controls the RF level at the CALIBRATOR OUTPUT jack. Its three positions are OFF, -20 dBm (10 μW) and +10 dBm (10 mW).

e. +10 dBm CAL ADJUSTMENT. This screwdriver adjustment allows the instrument to be standardized to the 10 mW from the calibrator. The procedure for making this adjustment is described in Section 3.5.1c. The CAL FACTOR lever switch should be set to 0 and the CAL FACTOR light off.

f. -20 dBm CAL ADJUSTMENT. This screwdriver adjustment allows the instrument to be standardized to the 10 mW from the calibrator. The procedure for making this adjustment is described in Section 3.5.1c. The CAL FACTOR lever switch should be set to 0 and the CAL FACTOR light off.

g. TRIGGER SELECTOR SWITCH. This three-position switch selects the triggering mode for the unit. Triggering in the INTERNAL position is under the control of the INTERNAL TRIGGER LEVEL control described in h. below. In the EXTERNAL position a 1 V. positive pulse of 200 nS or more is required to trigger the unit. In the FREE RUN position no trigger is required and the instrument continuously samples the input RF. This position is used when measuring CW power or calibrating the instrument.

h. INTERNAL TRIGGER LEVEL CONTROLS. The DIRECT INPUT (dBm) switch allows the coarse setting of the internal trigger level and the knob permits fine adjustments between switch positions. These controls set the gain of the internal trigger amplifier and thus control the point at which triggering occurs. The labeling above the three positions of the switch provides a rough guide for setting it with respect to input power level. The controls permit a proper compromise between excess trigger sensitivity where the instrument is likely to trigger from spurious signals and noise, and insufficient sensitivity where it will not trigger at all. In general, the sensitivity should be set somewhat above the point where the unit begins to trigger. In addition, these controls set the amplitude of the signal at the MONITOR OUTPUT jack, as the same amplifier is used to supply the trigger circuits and the monitor output signal. If the controls are set so that the signal from the MONITOR OUTPUT is between 0.5 and 1 V triggering should occur reliably and the output waveform should conform well to the input waveform, within the risetime limitation specified.

i. TRIGGER DELAY. This ten-turn control is used to adjust the time delay between the point at which a trigger occurs and the point when a sample of the RF pulse is taken. This allows the instrument to be set to read the peak of the waveform or any other appropriate point. The delay is adjustable between 0 and 100 μS and is indicated by the digital indicator above the knob.

j. TRIGGER RESET CONTROLS. Before the instrument can take a reading the trigger circuit

must be reset. This is normally done automatically after a period of time sufficient for the operator to assimilate the data on the digital display. This time is set by the RATE control. As long as the dot on the RATE control is clockwise of the AUTO marking on the panel, the trigger will reset automatically after a period between 1 mS and 3 S, depending upon the position of the knob. When the dot is at EXT the trigger must be reset by an external pulse applied to the TRIGGER RESET INPUT jack or manually, by means of the MANUAL pushbutton. After the trigger has been reset, the instrument will trigger on the first trigger following. The RESET light indicates the reset condition, a feature of value when measuring single pulses. In general, the operation of these controls is similar to the single sweep controls found on oscilloscopes.

k. PULSE AVERAGING SWITCH. When measuring a train of pulses of equal amplitude it is desirable to display the moving average in order to reduce the effects of noise. The instrument will do this when this switch is set to ON MAX RESET. This position disables the RESET controls insuring that the maximum number of pulses will be averaged per unit time. If desired to average selected pulses, the control can be set to ON and the reset controls will function normally (this mode would only be used in conjunction with an external reset pulse). When set to OFF, no averaging takes place and the amplitude of each pulse sampled is displayed.

3.2 FRONT PANEL INDICATORS

a. DIGITAL DISPLAY. Display tubes indicate the power in the linear modes. In the Log mode, the signal level is displayed in dB relative to the reference indicated at the right-hand edge of the display. The sign indicator is active only in the Log mode. The measurement units are indicated directly to the right of the numerical display.

b. OVER RANGE LIGHT. When lit, this light indicates that the measuring capacity of the instrument has been exceeded and another range must be selected or the input power reduced. On the 10 mW or +10 dBm ranges the light will go on only when power in excess of 10 mW has been applied to the detector. Thus, an indication of over-range can serve as a warning to reduce the power to the detector to avoid exceeding the 50 mW maximum rating.

c. NEW DATA LIGHT. This light flashes each time new data is aupplied to the digital display. At high pulse repetition rates, the light will appear to glow continuously.

d. TRIGGER RESET LIGHT. This light indicates that the trigger circuit has been reset. See description under 3.1j above.

e. CAL FACTOR LIGHT. This light serves as a warning that the CAL FACTOR control is operative and that a correction has been applied to the reading.

3.3 FRONT PANEL CONNECTORS

a. INPUT TYPE N CONNECTOR. This connector, located on the power detector head is the RF input to the unit. The input impedance is 50Ω. Detailed specifications are listed in Table 1-1.

CAUTION

UNDER NO CIRCUMSTANCES SHOULD THE POWER INPUT TO THE DETECTOR EXCEED 50 mW, PEAK. FAILURE TO OBSERVE THIS PRECAUTION WILL RESULT IN DAMAGE TO OR BURN OUT OF THE SENSITIVE DETECTOR DIODE.

b. CALIBRATOR OUTPUT JACK. This type N jack supplies 105 MHz RF power for calibrating the instrument. Output impedance is 50Ω. Output level is determined by the calibrator switch described in Section 3.1d.

c. MONITOR OUTPUT. This BNC jack supplies a signal corresponding to the detected video output of the detector. It may be viewed using an oscilloscope having a rise time of 20 nS or less. The signal level is adjustable using the INTERNAL TRIGGER LEVEL control. See Section 3.1h and 3.5.2b. Impedance is nominally 50Ω.

d. TRIGGER INPUT BNC JACK. This connector accepts triggers synchronous with the input RF pulse. Triggers must exceed 1 V for at least 200 nS. Impedance is 1000Ω.

e. TRIGGER RESET INPUT BNC JACK. This connector accepts pulses to reset the trigger circuit. Pulses must exceed 1 V for at least 200 nS. Impedance is 1000Ω.

3.4 REAR PANEL CONNECTORS

a. POWER JACK. This jack accepts a three-conductor power cord. The center pin is tied to the chassis of the instrument. See WARNING under Section 2.3.

b. REFERENCE PULSE OUTPUT. Each time a sample is taken of the input, an 80 nS pulse is supplied to provide an accurate time reference at the sampling instant. Impedance is nominally 50Ω.

3.5 OPERATING PROCEDURE

CAUTION

CONTINUOUS OR PEAK POWER LEVELS IN EXCESS OF +17 dBm (50 mW) CAN DAMAGE THE CRYSTAL DIODE IN THE DETECTOR. ALWAYS TAKE PRECAUTIONS TO INSURE THAT THE DETECTOR INPUT WILL BE WELL BELOW THIS POWER LEVEL BEFORE CONNECTING IT TO A SOURCE OF RF POWER.

3.5.1 CALIBRATION

a. Connect the line cord. Be sure that it is properly grounded. Refer to Section 2.3 for grounding precautions.

b. Turn the POWER switch to ON. The digital display should light immediately.

c. Allow at least 10 minutes for warm-up and temperature stabilization (longer if the instrument has just been brought in from an extremely cold environment). Attach the detector to the CALIBRATOR OUTPUT jack and set the CALIBRATOR switch to -20 dBm. Set the CAL FACTOR lever switch to 0, the TRIGGER switch to FREE RUN, and the PULSE AVERAGING switch to ON MAX RESET. Depress the DIRECT button.

Depress the 100 µW button and adjust the -20 dBm CAL screwdriver adjustment so that the display reads 10.0 µW. Now depress the 10 mW button and move the CALIBRATOR switch to +10 dBm. Adjust the +10 dBm screwdriver adjustment until the display reads 10.00 mW. If it has been necessary to make a large adjustment at either level, repeat the procedure as there is a slight interaction between the two adjustments.

3.5.2 GENERAL APPLICATIONS, CW AND REPETITIVE PULSE MEASUREMENT

a. Connect the detector to the measurement point. BE SURE THAT NO MORE THAN 50 mW PEAK OR CW IS AVAILABLE AT THIS POINT. If it is desired to measure power in excess of the +10 dBm measuring capability of the Model 1018A, connect suitable attenuators or directional couplers between the detector and the RF source. For example: to measure 1 kW, a 60 dB coupler would be appropriate.

b. Set the TRIGGER selector switch as required. If pulse power is measured, either INTERNAL or EXTERNAL triggering is required. For CW power set it to FREE RUN. If external triggering is used, supply a pulse with 1 V (positive) amplitude or greater and a minimum duration of 200 nS to the TRIGGER INPUT connector. If internal triggering is used, set the DIRECT INPUT (dBm) switch to the approximate level of the signal to be measured. Adjust the LEVEL knob for reliable triggering. The PULSE AVERAGING switch should be set to ON MAX RESET to minimize the effects of noise.

c. Adjust the TRIGGER DELAY to the desired point. The DELAY control, calibrated in µS, can be set to cause the instrument to take a sample at any desired point within its range. There is approximately 0.2 µS fixed delay between the arrival of a trigger and the sampling point when the TRIGGER DELAY control is set to 00.0. As an aid to adjusting this control, the sampling pulse is superimposed upon the RF pulse envelope from the MONITOR OUTPUT. Also, a reference pulse is available from a rear panel connector to indicate the sampling point. The trailing edge of the reference pulse is the sampling point. An oscilloscope with a rise-time of less than 20 nS is required to observe the monitor output, or the reference pulse. The INTERNAL TRIGGER LEVEL control should be readjusted so that the pulse from the MONITOR OUTPUT is between 0.5 and 1.0 V to avoid waveform distortion and provide reliable triggering. Final adjustment to the peak of the waveform can be done with reference to the digital display. If it is desired, other points besides the peak can be sampled. Using the DELAY dial and the digital display a plot of the waveform can be constructed (within the rise-time limitations of the instrument).

3.5.3 SINGLE PULSE MEASUREMENT

a. Connect the detector to the measurement point. BE SURE THAT NO MORE THAN 50 mW PEAK OR CW IS AVAILABLE AT THIS POINT.

b. Set the controls as follows:

TRIGGER RESET RATE	- EXT
PULSE AVERAGING	- OFF
TRIGGER	- INT
INTERNAL TRIGGER LEVEL	- To the range within which the expected signal falls.
CAL FACTOR	- AS REQUIRED
RANGE	- dBm or the linear range which will not be driven over-range by the input signal.
TRIGGER DELAY	- As required; in general to a setting equal to one half the pulse width.

c. Press the MANUAL RESET TRIGGER before the pulse is expected; the TRIGGER RESET light should be lit. When the light goes out and the NEW DATA light flashes the pulse has arrived and the power measured will be displayed for a five second interval.

3.5.4 MEASUREMENT OF SELECTED PULSES WITHIN A TRAIN

a. Connect the detector to the measurement point. BE SURE THAT NO MORE THAN 50 mW PEAK OR CW IS AVAILABLE AT THIS POINT. Set the controls as in 3.5.3b except for the TRIGGER switch, which is set to EXT and the RESET RATE, which is set to MAX or as required. Apply an external trigger to the TRIGGER INPUT jack. The timing between the leading edge of the trigger pulse and the RF pulse must be known to within 10% of the pulse width. Set the delay to the time between the leading edge of the trigger pulse and the leading edge of the RF pulse plus one half of the RF pulse width.

b. If a train of pulses is less than 100 µS long and the repetition rate of the train is less than 500 Hz, another method can be used not requiring an external trigger source. Set the controls as in 3.5.3b, except for the RESET RATE, which is set to MAX or as required. Set the TRIGGER DELAY to the time between the leading edge of the first pulse and the leading edge of the pulse to be measured, plus one half the measured pulse width.

c. Where there is considerable jitter between the trigger pulse and the RF pulse, another method is possible. Set the controls as in 3.5.3b. Apply a trigger to the TRIGGER RESET INPUT just prior to the desired pulse but after the previous pulse. This resets the trigger circuit and it will trigger on the desired pulse. The TRIGGER DELAY is set to one half the pulse width.

3.5.5 MEASURING PULSE WIDTH

The Model 1018A may be used to measure the pulse width without the aid of an oscilloscope by using the following procedures:

a. Follow the operating procedure of Sections 3.5.2, 3.5.3, or 3.5.4.

b. Measure the peak power of the pulse using the dBm mode, note the reading. Next adjust the TRIGGER DELAY so that the sample point is on the leading edge of the pulse and the digital display reading 3.0 dB down. To do this you may have to use an external pretrigger. Note the reading on the TRIGGER DELAY in µs. Move the sample point to the trailing edge and 3 dB down. Note the TRIGGER DELAY reading and subtract the first reading from it. The difference is the pulse width at the 50% (-3 dB) points. Other points may be chosen if desired.

3.5.6 MEASURING PULSE RISETIME

The pulse rise or fall time may be measured using the following procedures if the rise-time exceeds 100 nS.

a. Follow the operating procedure of Section 3.5.2.

b. Measure the peak power using the appropriate linear scale, i.e., mW or μW. Then in turn adjust the TRIGGER DELAY until the digital readout reads 10% and 90% (power) of the peak value, while noting the TRIGGER DELAY setting at each position. The difference is the pulse risetime in μs. You may have to use an external pretrigger so that the TRIGGER DELAY control can move the sample point up and down the leading edge. The same measurement can be made on the trailing edge of the pulse.

3.5.7 MEASUREMENTS WHERE RF CABLES ARE REQUIRED

If an RF coaxial cable is used between the measurement point and the detector there will be an error due to the RF loss in the cable. This can be compensated out of the measurement by using the following procedure:

Obtain a CW signal source at the frequency of the desired measurement capable of between one and ten mW. Measure the source output using the procedure of Section 3.5.2, first connecting the detector directly to the source output. Note the reading. Now insert the cable between the source and the detector and adjust the CAL FACTOR switch until the same reading is displayed as was previously noted. Leave the CAL FACTOR switch in this position for subsequent measurements using the cable.

3.5.8 MEASURING MODULATION

The Degree of Modulation of microwave and RF signals modulated with repetitive audio or video waveforms can be determined by using the Model 1018A in the setup shown in Fig. 3-1. This procedure is especially useful when the microwave signal is pulsed and sine-wave modulated simultaneously.

3.5.8.1 MODULATED CW SIGNALS

a. Follow the operating procedure and precautions of Section 3.5.2.

b. Connect the delay generator on the delayed output from the oscilloscope to the EXT TRIGGER INPUT.

c. Adjust the delay so that you are measuring the maximum power level, using the linear ranges, at point P_A in Figure 3-2 (assume signal shown is CW).

d. Readjust the delay so that you measure the minimum power level at point P_B in Fig. 3-2.

e. If you can turn off the modulation, then measure level P_C which is the CW level without modulation then use Equation 1. If you cannot remove the modulation, use Equation 2.

f. The Degree of Modulation is then calculated from the formulae:

$$M = \frac{\sqrt{P_A} - \sqrt{P_B}}{2\sqrt{P_C}} \qquad \text{Equation 1.}$$

$$M = \frac{\sqrt{P_A} - \sqrt{P_B}}{\sqrt{P_A} + \sqrt{P_B}} \qquad \text{Equation 2}$$

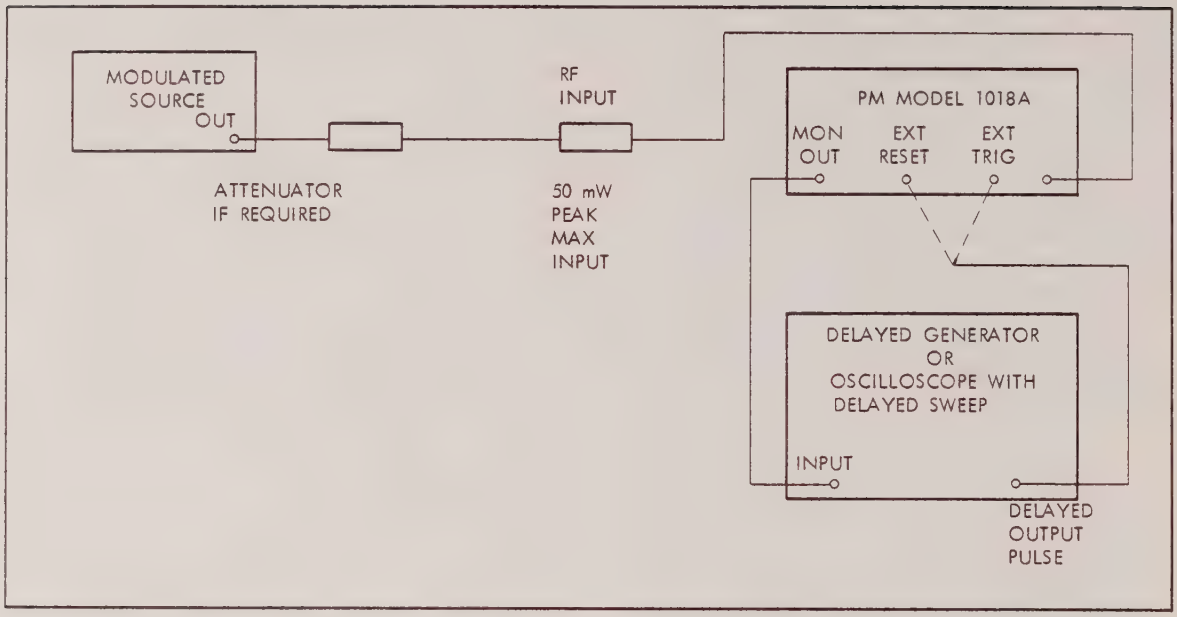
3.5.8.2 MODULATED PULSED SIGNALS

a. Follow the operating procedure and precautions of Section 3.5.2.

b. If there is very little jitter at the end of the delay and the measurement point is at the same point on the desired pulse each time, then the delayed pulse can be applied to the EXT TRIGGER INPUT. If it is not stable then apply it to the EXT RESET INPUT and operate the TRIGGER on INTERNAL.

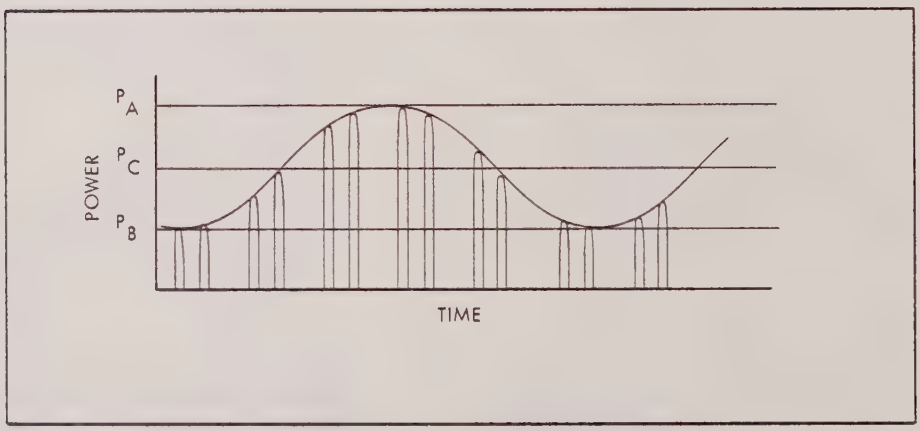
c. Adjust the delay so that you are measuring the maximum power level using the linear ranges. at point P_A in Figure 3-2. Note that you are resetting the trigger circuit just prior to the arrival of the desired pulse and since you are using internal triggering, pulse jitter, delay jitter or random pulse spacing does not affect the measurement.

d. Use Steps 3.5.8.1d, e, and f above to figure the Degree of Modulation.



MODULATED MEASUREMENT SET-UP

FIGURE 3-1



MODULATED PULSED RF SIGNAL

FIGURE 3-2

SECTION 4

PERFORMANCE CHECKS

4.1 PURPOSE

The checks given in this section are useful for incoming inspection or periodic evaluation of instrument performance. If the instrument fails to meet one or more of the performance criteria listed here, refer to Section 6 for information on making the necessary adjustments.

4.2 EQUIPMENT REQUIRED

The following equipment is required to make the performance checks:

a. RF sweep sources covering at least 4.5 to 8 GHz, and 8 to 12.4 GHz. Source should have 10 mW output and a source SWR of <1.2 up to 7 GHz and <1.25 to 12.4 GHz. If a source of higher power but poorer SWR is available, a suitable attenuator may be used to improve the SWR. Harmonics and spurious must be down 50 dB. If only harmonics are a problem, a low pass filter may be inserted between the generator and the attenuator. Two are required to cover each octave. The sweeper should be leveled by means of feedback obtained from a directional coupler.

b. A set of directional couplers covering 4.5 GHz to 12.4 GHz with minimum directivity of 30 dB.

c. A precision power bridge and thermistor mount. The thermistor mount should have its calibration factor known to and uncertainty of <1% at 100 MHz. The bridge should contribute less than 0.5% error to the measurement.

d. A set of high quality attenuators equipped with precision Type N connectors. The SWR of each attenuator should be 1.2 to a frequency of 4.5 GHz. The attenuators should have attenuation values of 3, 6, 10 and 20 dB. Calibration data should be obtained giving the attenuation of the attenuators individually and in tandem to produce attenuations of 13, 16, 23 and 26 dB. The calibration data should be accurate to at least 0.02 dB/10 dB.

e. A pulse generator with 10 nS minimum rise-time, capable of supplying a 1 V negative pulse into 50Ω. There should be a 1 V positive trigger available 1 µs ahead of the output pulse.

f. An electronic counter capable of time interval measurement with independent start and stop inputs with 100 nS resolution. It must respond to a stop command of 80 nS duration.

g. An oscilloscope with 50 mV/division sensitivity and a rise time of <20 nS, and 200 µV sensitivity at reduced bandwidth.

4.3 CALIBRATOR

Since the calibrator is the primary reference for the instrument, the accuracy of its output is very important. For this reason, it is carefully adjusted before leaving the factory so that its output, as measured by the instrument agrees with a standard source maintained by Pacific Measurements. It may be checked only if a high accuracy power measurement bridge is available. Do not attempt to to adjust the calibrator using an ordinary bench type power meter.

a. Carefully set the bridge balance with the thermistor mount attached to the CALIBRATOR OUTPUT with the calibrator switched off.

b. Turn the calibrator to +10 dBm and measure the power applied to the thermistor. It should measure 10 mW ± 0.3 mW. Note that this represents a 3% possible deviation. This deviation is possible because of the 1.5% specification on the test equipment used to measure it. It if is desired to cause the calibrator output to agree with the measurement standard, it may be adjusted by means of the recessed screwdriver adjustment located on the rear panel of the instrument.

4.4 POWER LEVEL TRACKING AT 100 MHz.

The following test checks the linearity of the instrument.

a. Set the controls on the Model 1018A as follows:

PULSE AVERAGING	ON-MAX RESET
TRIGGER	FREE RUN
CAL FACTOR LEVER SWITCH	0
CALIBRATOR	+10 dBm
RANGE	+10 dBm DIRECT
TRIGGER DELAY	any
CAL FACTOR - dB	any

b. Connect the detector to the CALIBRATOR OUTPUT and adjust the +10 dBm CAL control so that the display reads 10.00 mW. Set the CALIBRATOR switch to -20 dBm and set the -20 dBm CAL if required.

c. Check the tracking of the instrument using the values shown in Table 4-1. You will have to compute the correct value for the display for each attenuation by multiplying the value given under "READING" by the correction factor known from the attenuator calibration data. If the correction is given in dB, derive the corresponding linear equivalent by the following formula:

$$\text{LINEAR CORRECTION} = \text{ANTILOG}\ \frac{\text{CORRECTION IN dB}}{10} \qquad \text{(Eq. 4-1)}$$

For calibration correction values to 0.3 dB see Table 6-1. The table has blank spaces provided so that you can write in the corrected values for your attenuators, either in the manual or in a photocopy of the table. Under "DEVIATION PERMITTED", there are three points where resetting the +10 dBm CAL adjustment is called for. There is, of course, no correction to the reading at +10 dBm, as no attenuator is used there. The other two points must be set to the corrected value. The deviations listed for the 100 µW range make allowance for noise.

4.5 CAL FACTOR CORRECTION ACCURACY.

The following test checks the accuracy of the CAL FACTOR control.

a. Set the controls as in 4.4a. Connect the detector to the CALIBRATOR OUTPUT and set the +10 dBm CAL adjustment so that the display reads 10.00.

b. Turn the CAL FACTOR lever switch to - and successively turn the CAL FACTOR - dB rotary switch from .05 through each position, ending at 1.0. At each step compare the display reading with the values in Table 4-2. Repeat with the lever switch set to +. The values read from the display should agree with those from the table within 5 digits.

4.6 POWER SENSITIVITY AT 100 MHz, 4.5 GHz, 8 GHz AND 12.4 GHz.

The following test determines the variation in power sensitivity at four selected frequencies. Note that this measurement cannot be performed unless a well matched, harmonic- and spurious-free RF source is available. Observe the caution below.

CAUTION

MANY RF SOURCES CAN GENERATE POWER IN EXCESS OF THE AMOUNT REQUIRED TO DAMAGE OR DESTROY THE DETECTOR. BE ABSOLUTELY CERTAIN THAT ENOUGH ATTENUATION HAS BEEN PLACED BETWEEN THE SOURCE AND THE DETECTOR TO REDUCE THE POWER TO A SAFE LEVEL BEFORE APPLYING POWER TO THE DETECTOR.

a. Check and set the -20 dBm CAL adjustment, see Section 3.5.1c.

TABLE 4-1

RANGE	ATTENUATION (dB)	READING	CORRECTED READING	DEVIATION PERMITTED (±)	
10 mW	0	10.00	10.00	.01	(Set)
10 mW	3	5.01		.06	
10 mW	6	2.51		.04	
10 mW	10	1.00		.02	
1 mW	10	1.000		.001	(Set corr. reading)
1 mW	13	.501		.006	
1 mW	16	.251		.004	
1 mW	20	.100		.002	
100 µW	20	100.0		.1	(Set corr. reading)
100 µW	23	50.1		.8	
100 µW	26	25.1		.6	
100 µW	30	10.0		.4	

TABLE 4-2

CAL FACTOR SETTING (dB)	DISPLAY READING (+)	(-)
.05	10.12	9.89
.1	10.23	9.77
.15	10.35	9.66
.2	10.47	9.55
.25	10.60	9.44
.3	10.72	9.33
.35	10.84	9.22
.4	10.96	9.12
.45	11.09	9.02
.5	11.22	8.91
.55	11.35	8.81
.6	11.48	8.71
.65	11.61	8.61
.7	11.75	8.51
.75	11.88	8.41
.8	12.02	8.32
.85	12.16	8.22
.9	12.30	8.13
.95	12.45	8.04
1.0	12.59	7.94

b. Set the controls as indicated in 4.4a. Connect a 10 dB attenuator to the CALIBRATION OUTPUT and measure the output using the power bridge. Set the +10 dBm CAL adjustment so the display agrees with the power bridge on the 1 mW scale.

c. Using the power bridge, set the RF source to give 1 mW at 4.5 GHz. Be sure to include the calibration factor of the thermistor mount when setting the power. Connect the Model 1018A detector to the 1 mW source and record the display reading. Be sure that the instrument checks at -20 dBm on the CALIBRATOR. Repeat the measurement at 8 GHz and 12.4 GHz. The readings should agree with those listed below within the limits shown.

FREQUENCY	MINIMUM	MAXIMUM
4.5 GHz	.955	1.045
8.0 GHz	.915	1.085
12.4 GHz	.865	1.135

The values given above include an allowance of 1.5% for the accuracy of the power bridge.

4.7 INPUT REFLECTION COEFFICIENT BETWEEN 4.5 GHz AND 12.4 GHz

This check verifies the reflection coefficient (VSWR) of the detector. This is done using swept frequency techniques to avoid missing a point where the return loss of the detector is low. The technique is standard and detailed information is included in the operating instructions supplied with any RF sweep generator. What follows is a brief description of the procedure with attention given to specifications.

a. To minitor the reflected wave, connect a directional coupler to the output of a leveled sweep signal generator covering the frequency range between 4.5 and 12.4 GHz. Normally this will require two set-ups, one covering the lower portion of the band and another covering the remainder. It will probably be necessary to use an attenuator between the signal generator and the directional coupler to preclude the possibility of exceeding the detector power rating. See the caution under 4.6. Also, remember that harmonic output from the signal source will cause errors, so suitable low pass filters should be used.

b. With the output end of the directional coupler open circuited, connect attenuators totalling 16 dB to the arm of the coupler. Connect a crystal detector to the attenuators and monitor its output with a sensitive oscilloscope. Set the sweep generator to cover the band from 4.5 to 8 GHz and mark the scope face with grease pencil over the trace.

c. Connect the Model 1018A power detector to the output port of the coupler, remove the attenuator from the arm and connect the crystal detector directly to the arm. The trace should fall below the marking on the face of the oscilloscope.

d. Repeat the above procedure between 8 GHz and 12.4 GHz, using a 14 dB attenuator. A 13 dB attenuator will be usable also if 14 dB is unavailable.

4.8 INPUT CIRCUIT RISE-TIME

The following test determines the rise-time of the instrument.

a. Set the pulse generator to give a negative pulse of 1.0 V amplitude when terminated in 50Ω. The duration of the pulse should be approximately 5 μS. DO NOT EXCEED 1 V AMPLITUDE. Set the repetition rate to 500 Hz. Set the delay between the trigger pulse and

the output pulse to be approximately 1 μS. Connect the trigger pulse to the TRIGGER INPUT of the Model 1018A. Connect the detector to the output pulse.

b. Set the controls on the Model 1018A as follows:

PULSE AVERAGING	ON-MAX RESET
TRIGGER	EXT.
CAL FACTOR LEVER SWITCH	0
CALIBRATOR	OFF
RANGE	+10 dBm DIRECT
TRIGGER DELAY	3.4 μS
CAL FACTOR - dB	Not applicable

c. Adjust the pulse generator amplitude so that the display reads 10.00 mW. Now reduce the setting of the TRIGGER DELAY control until the display reads 9.00 mW and note the reading of the DELAY dial. Continue reducing the delay until the display reads 1.00 mW and again record the delay reading. Subtract the second reading from the first; the difference is the rise-time of the input circuit. The rise-time should be less than 100 nS.

d. Connect the oscilloscope to the MONITOR OUTPUT and adjust it to display the 5 μS pulse that will be present there. Adjust the TRIGGER LEVEL controls to give 0.5 V as read from the oscilloscope. Set the oscilloscope to 0.1 V/division and read the time required for the pulse to cover the 4 divisions from 0.5 division (10%) up from the bottom to 0.5 division (90%) down from the top of the pulse. This is the rise-time of the monitor; it should be less than 0.1 μS.

4.9 CALIBRATION OF THE DELAY DIAL

The following procedure checks the calibration of the DELAY dial.

a. Set the TRIGGER control to EXT. Connect the output from the pulse generator to the TRIGGER INPUT and with a tee connector to the start input of the counter. Connect the rear panel REFERENCE output to the stop input of the counter. Set the pulse generator to supply a 1 μS, 1 V positive pulse. It should be set in a single pulse mode.

b. Set the dial on the DELAY control to 0 (minimum) delay. Trigger the pulse generator and note the reading on the counter. Repeat the procedure with the dial set to 10 μS, 20 μS, etc., to 100 μS. Subtract the reading at zero from the subsequent readings. The result should be correct, within ± 2 μS.

SECTION 5

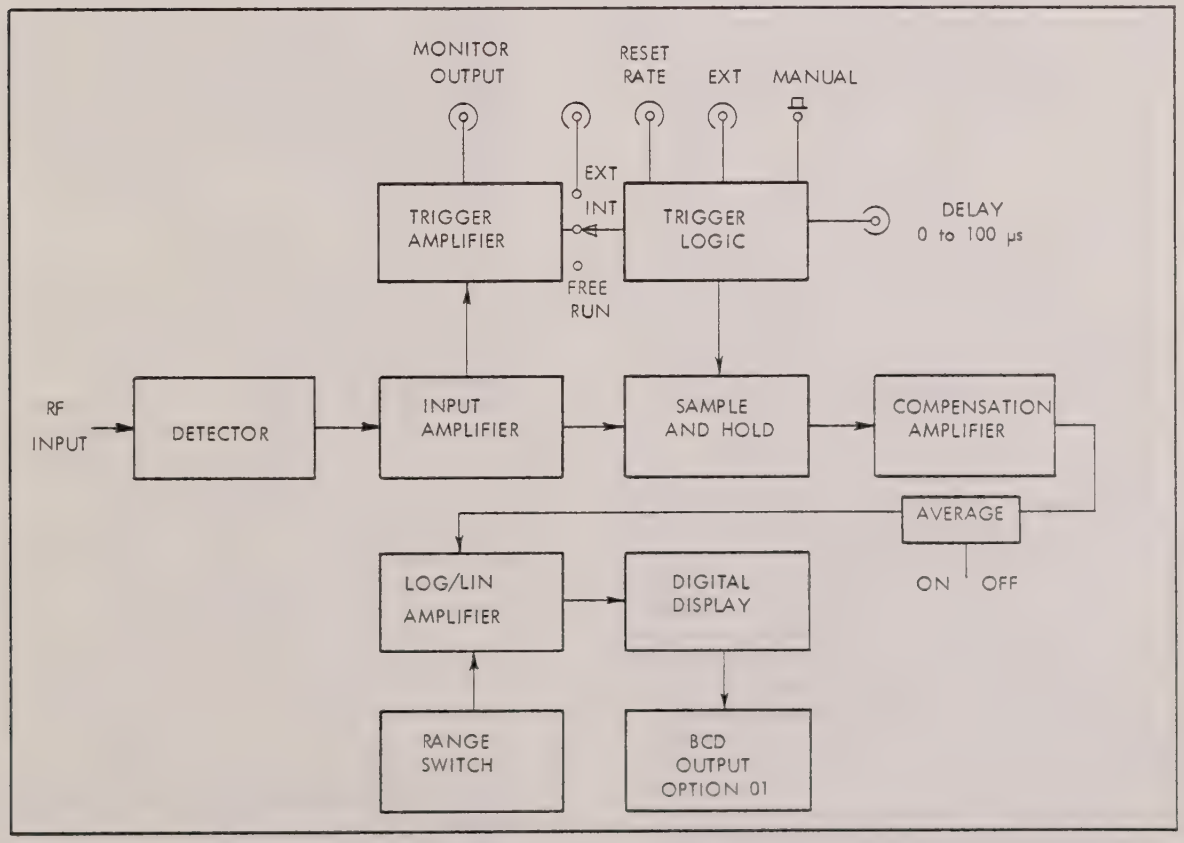
CIRCUIT DESCRIPTION

5.1 GENERAL

A simplified block diagram of the Model 1018A is shown in Figure 5-1. The RF signals applied are to the detector. The output of the detector is amplified in a low noise, wide band amplifier. A trigger amplifier monitors the output of the input amplifier and feeds the trigger circuits. In addition, the output of the trigger amplifier drives the monitor output jack so that the detected video pulse may be observed with an oscilloscope. The trigger logic is actuated by the output of the trigger amplifier when the trigger selector switch is in the INTERNAL position. When the trigger selected switch is set to EXTERNAL, an external 1 volt pulse is required to actuate the trigger logic. In the FREE RUN position, the trigger logic is actuated immediately following the completion of one measurement cycle, so that the instrument takes readings at the most rapid possible rate.

The trigger logic includes a delay circuit which permits a manual adjustment of the period between the arrival of the trigger and the point at which a pulse is sent to the sample-and-hold circuit. The trigger circuit will be reset so that it will accept additional triggers after a period of time controlled by the RESET RATE control. If the RESET RATE control is turned counterclockwise to the EXT position the trigger logic can be reset by either an external pulse or a manual pushbutton.

After the trigger delay has occurred, a pulse is applied to the sample-and-hold circuit causing it to retain the data at the output of the input amplifier at that instant. The sample-and-hold circuit feeds a compensation amplifier which corrects for the crystal detector characteristics and generates a voltage proportional to input power over the entire dynamic range of the system. In order to obtain the correct scale factor for



SIMPLIFIED BLOCK DIAGRAM
FIGURE 5-1

each display range, the signal from the compensation amplifier is amplified either logarithmically or linearly, depending upon the function selected, and applied to the digital display. The digital display converts the analog information at its input into binary coded decimal digital form. This data is then decoded for display by the display tube drivers and also is supplied to the BCD interface circuit for output as a BCD signal to data acquisition equipment.

5.2 BLOCK DESCRIPTIONS

5.2.1 INPUT AMPLIFIER

The input amplifier of the Model 1018A is an operational amplifier with field effect transistor input. Its gain is adjustable to compensate for different detector sensitivity. Its dc input is stabilized by means of a separate chopper amplifier which monitors the input summing junction voltage and feeds a corrective signal back to its positive input. The chopper amplifier uses field effect transistors as chopper switches operating at a 600 Hz carrier frequency. The field effect transistors avoid the service problems of earlier electromagnetic choppers and permit higher frequency operation which avoids the I/F noise associated with lower frequency operation.

5.2.2 TRIGGER CIRCUIT

Refer to the circuit diagram, Drawing Number 12073. A trigger is defined as a positive transition at pin 6 of U3. Recognize that U3 is a pair of 4 input nand gates wired to form an R-S flip-flop. Assume that U3 has been reset to begin with. A trigger will be generated if any one of the 3 externally connected inputs to U3 is driven negative. This will happen if a trigger is supplied externally through T3 and Q6 or if a trigger comes from the internal trigger amplifier UI and the trigger comparator U2. Only one of these two paths is enabled, however, as the trigger selector switch disables one path or the other. The third input is used to cause a trigger to occur after 5 seconds if no proper trigger has arrived, so that the display will not retain a reading indefinitely, leading to possible operator confusion.

The arrival of a trigger starts a timing sequence allowing the analog circuits sufficient time to react before the display responds. Immediately after the arrival of a trigger, the 500 µS delay (U4) and the 0 to 100 µS variable delay (Q15 to Q20) start their timing cycles. At the end of the variable delay a trigger is generated to drive the sampling circuit. At the end of the 500 µS delay a 1 mS pulse is generated (U5) to drive the final hold gate and the reset delay is started. At the end of the 1 mS period, a trigger initiates the read cycle of the digital display and enables the reset trigger generator (U8).

Depending upon the setting of the RESET knob, the reset delay circuit will generate a reset pulse to the trigger flip-flop immediately after it is enabled, or a time later, as controlled by the knob, or not at all (when the knob is set to EXT). In the external mode, a reset trigger must be supplied by pushing the RESET button or by a 1 V pulse supplied to the RESET INPUT jack. In any of the above cases, a negative pulse will be supplied to one of the reset inputs of the trigger flip-flop.

Five seconds after the end of the 500 µS pulse, the delay circuit comprising Q2, Q3, and Q4 generates a trigger which is fed back to the trigger flip-flop, initiating a read cycle. If there is no input to the detector the display will thereupon read zero.

In the average mode it is desirable to trigger the display only about 5 times per second, as the eye then can assimilate the information more readily. This is accomplished by the trigger generator (U6) which, after generating a trigger, is insensitive to further inputs for 200 mS.

5.2.3 SAMPLE-AND-HOLD CIRCUIT

The high speed sampler gate is driven by a pulse-forming circuit triggered from the trigger logic as indicated above. The sampler gate is open for approximately 80 ns, allowing sufficient time for the primary sample-and-hold capacitor to charge completely to the input amplifier's output voltage. An isolation amplifier with field effect transistor input monitors the voltage on the primary sampling capacitor and feeds it to the data-hold gate consisting of a field effect transistor and a large capacitor. The gate of the field effect transistor is driven from a 10 µS pulse-forming circuit. The data hold capacitor is quite large and stores its voltage for a time sufficient for the digital display to take a reading.

5.2.4 COMPENSATION AMPLIFIER

Crystal diode detectors have been used to measure RF power for quite some time, but until recently their useful measurement range has been restricted to the square law region where output voltage is approximately proportional to input power. In reasonably fast-response applications, the lower end of the measurement range is limited by noise and is about -20 dBm. The upper end of the usual measurement range occurs at about -10 dBm where the detector output response begins to depart significantly from square law. In the Model 1018A compensation for the crystal characteristic is obtained by using a diode shaping network in the feedback of the compensation amplifier. The result is that the output of the compensation amplifier is proportional to RF power to levels up to +10 dBm. This is possible because of the predictable behavior of the diodes used in crystal detectors.

Figure 5-2 shows the schematic of a typical crystal detector. The crystal diode, CR1, merely rectifies the RF voltage across the terminating resistor, R_t. In the Model 1018A R_t is a 50 ohm termination and

CR1 is a microwave point contact diode. The relationship between the peak RF input voltage, E, and the dc output of the detector, E_{dc}, is described by the following equation:

$$\left[1 + \left(\frac{R_V}{R_L}\right) E_{dc}\right] e^{\alpha E_{dc}} = I_o(\alpha E) \qquad \text{Equation 1.}$$

Where: R_V is the diode low level video resistance

R_L is the detector load resistance

α is proportional to Q/kt

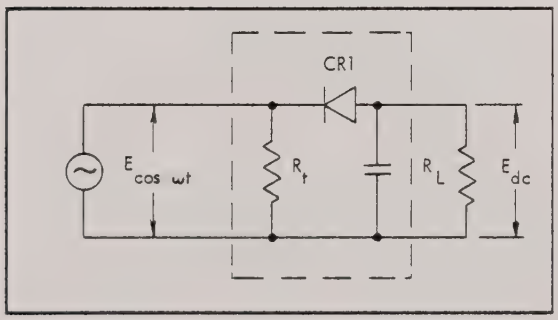
I_o is the zero order modified Bessel function of the first kind.

Below -20 dBm, Equation (1) may be approximated by the expression:

$$E_{dc} = \frac{\alpha E^2}{4(1+k)} \qquad \text{Equation 2.}$$

Where: k is R_V/R_L

The square law relationship shown in Equation 2 shows that the detector dc output is proportional to the RF input voltage which in turn is proportional to the RF input power. Equation 2 describes the desired detector response while Equation 1 describes the actual detector response.



DETECTOR

FIGURE 5-2

The compensation circuitry in the Model 1018A provides very little correction for low input levels; as the input level is increased, successive shunt diodes are engaged in the shaping network of the compensation amplifier increasing its gain to compensate for the departure from square law of the RF detector.

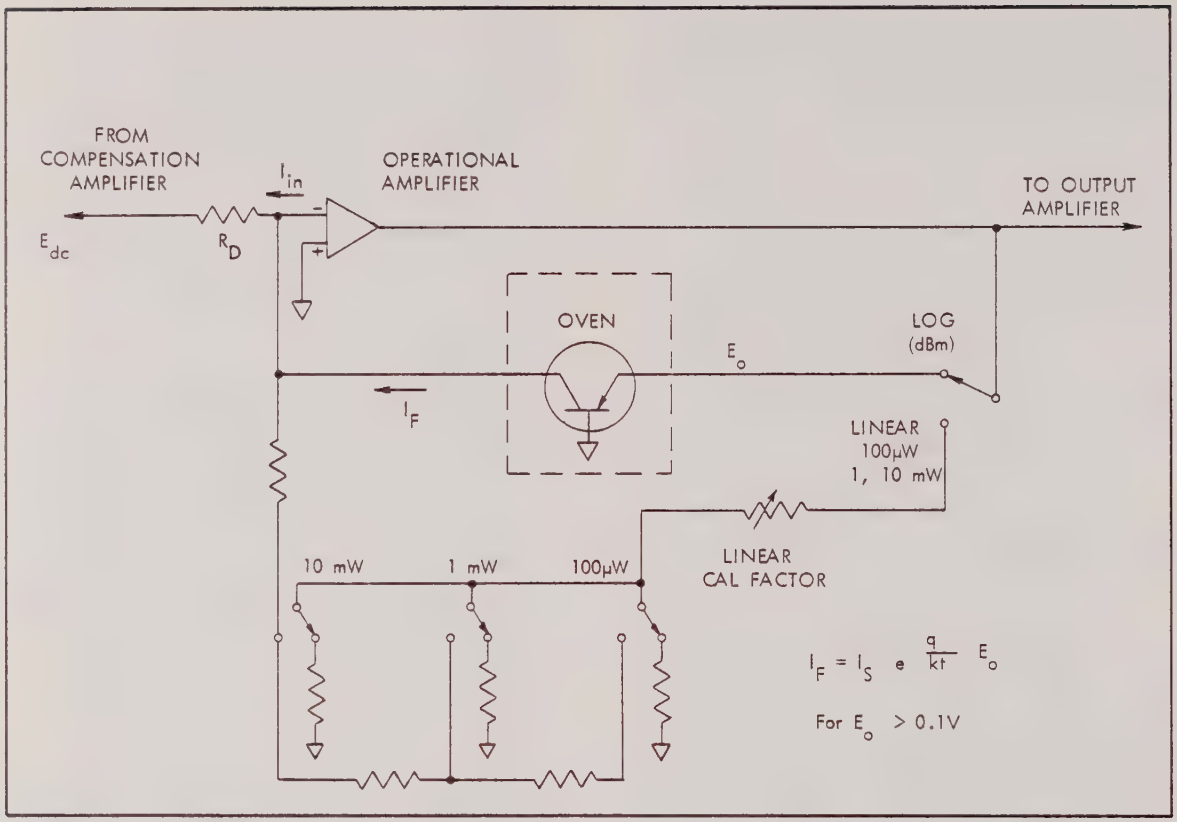
5.2.5 LOG/LIN AMPLIFIER

A simplified circuit diagram of the Log/Lin Amplifier is shown in Figure 5-3. This amplifier consists of a high gain, operational amplifier capable of being operated in logarithmic or linear mode by selection of its feedback network.

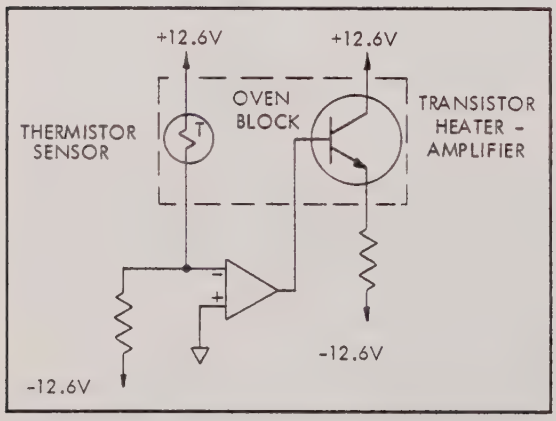
To operate the Log/Lin amplifier in the logarithmic mode, a transistor is used in the feedback loop around the operational amplifier. Referring to Figure 5-3, I_{in} is proportional to $e^{qE_o/kt}$ since the operational amplifier has very high gain. Thus, E_o is proportional to log I_{in}. This logarithmic relationship between I_{in} and E_o holds over many decades of current because parasitic collector currents in the logging transistor are eliminated by operating its collector base junction at zero volts. When operated in the logarithmic mode, the output level of this amplifier is approximately 6.4 mV/dB and is a function of the temperature of the logging transistor. To maintain the logarithmic coefficient independent of ambient temperature, the logging transistor is mounted in a temperature controlled oven and held at 50°C. The oven control circuit which maintains the oven at a constant temperature is shown schematically in Figure 5-4. A power transistor serves to heat the oven and a thermistor mounted in the oven senses temperature. A simple one-stage amplifier is connected between the thermistor and the transistor heater amplifier. When the oven is at its correct temperature, the driver amplifier input is very near zero volts and the transistor heater amplifier generates just enough heat to maintain the oven at its proper temperature.

In the linear mode the operational amplifier is controlled by a resistive feedback attenuator. In the linear mode the log/lin amplifier has three gain settings which correspond to 100 μW, 1 mW and 10 mW full scale. In addition, in the linear mode the amount of feedback is also controlled by the calibration factor switch which cascades a second attenuator in series with the range switching attenuator. The range switching attenuator presents a constant impedance to the calibration factor attenuator so that the effect of the calibration factor attenuator is independent of the particular range the instrument is set to. In the log mode another section of the calibration factor switch supplies offsetting current to the input of the operational amplifier monitoring the voltage of the logging transistor.

A separate amplifier is required to monitor the log transistor voltage in order to raise the signal level to the value required so that the digital display will read correctly. This amplifier is of the operational type, so that a current may be summed in corresponding to the fixed 50Ω reference level for dBm and the arbitrary reference level for dB. The output of the log/lin amplifier then feeds the digital display.



LOG/LIN AMPLIFIER
FIGURE 5-3



OVEN CONTROLLER
FIGURE 5-4

5.2.6 CALIBRATOR

In Section 7, Drawing Number 12109, is a circuit diagram of the RF calibrator. The calibrator consists of a 105 MHz oscillator and a 30 dB, 50 ohm attenuator. CALIBRATOR OUTPUT is from a front panel Type N Connector.

The 105 MHz oscillator-amplifier is operated within a very stable amplitude regulating loop so that its output is only a function of a reference voltage. The calibrator output level is set by adjusting the reference voltage divider. The amplifier output is fed to the calibrator switch from a 50 ohm attenuator tapped into the 105 MHz resonant circuit. In the first position, the calibrator switch de-energizes the calibrator. In the second position, the calibrator is energized and connected to the calibrator output through a 30 dB, 50 ohm attenuator. Finally, in the third position, the calibrator oscillator is energized and connected directly to the calibrator output to give +10 dBm (10 mW) output.

5.2.7 DIGITAL DISPLAY

The Pacific Measurements Digital Display is used to convert the analog signals developed by the instrument into digital form for direct readout using gas filled display tubes. In addition, it generates Binary Coded Decimal (BCD) signals which can be used with data acquisition systems.

In order to provide high speed, excellent long term stability and to make use of readily available, off-the-shelf integrated circuits, the digital display uses a successive approximation process in order to generate a display. The logic functions of the instrument are performed by integrated circuits. The actual process of approximation is done by transistor switches controlling high stability, precision resistors. Specialized integrated circuits are used to drive the display tube numerical indicators.

For descriptive purposes, the digital display unit can be broken down into four elements. The first, and fundamental, element is the reference supply which forms the standard for comparison against which all input voltages are measured. The second is the approximation circuit which generates the current to balance the current developed by the input voltage applied across the input resistor. The third is the comparator which generates the control signals to be applied to the approximation circuit. The fourth part of the system can be described broadly as the logic circuitry which provides the control information to permit the approximation in process to proceed in an orderly, sequential fashion. In principle, the process of successive approximation is merely an automatic way of doing what an operator of a differential voltmeter does by hand. The user of a differential voltmeter measures an input voltage by obtaining an approximate null; setting the most significant digit on the instrument first and then progressively refining the approximation by setting successively less significant digits, until all available digits have been set.

In the Pacific Measurements Digital Display, the process of approximation is carried out in a BCD sequence, that is, all the numbers from zero through nine are derived by adding the Binary numbers 0 1 2 4 8 to form each decade. In order to form three decades, twelve nonzero numbers are required. Since the Pacific Measurements Digital Display also has the capability of displaying the overrange 1, an additional number is required for a total of 13. The approximation circuit consists of 13 solid state switches connected to 13 precision resistors. If a switch is actuated, it will connect one end of the resistor to a precise reference voltage. The opposite end of each resistor is tied to a common point together with a precision resistor leading to an input voltage. In addition, a high gain, integrated circuit differential amplifier monitors this point to serve as a null detector, or comparator.

The approximation process is performed under control of the logic circuit, so that the resistor corresponding to the most significant Binary digit is selected first, then the next significant digit and so on until the least significant digit has been determined. By proceeding in this fashion, advantage may be taken of the fact that each binary digit which is not in excess of the input is required in the answer. Thus, the logic circuits first connect a given resistor to the reference supply, the comparator determines whether the current through the resistor is greater or less than that required to produce a null. If it is greater, the logic disconnects the resistor; if it is less, the resistor remains connected. At the end of the approximation process, resistors are connected between the null point and the reference supply to correspond to BCD numbers equal to the input voltage. The control voltages applied to the switches are also the BCD output, and they are decoded into decimal form to drive the display tubes.

Since the approximation process operates in one direction only, the instrument will accept signals of only one polarity at its input. In order to permit measurements of signals of both polarities and to isolate the rest of the instrument from noise generated in the digitizing process, an "absolute value circuit" is included in the system. If a negative input is applied to the instrument, the input resistor is connected through a noninverting amplifier to the voltage to be measured. If a positive voltage is applied to the input, the input resistor is connected through both the inverting and noninverting amplifiers to the input voltage.

REFERENCE SUPPLY

Refer to the circuit diagram 10843, sheet 1, in Section 8. The reference supply is a high gain dc amplifier. The input stage of the amplifier is a temperature stable silicon dual NPN transistor. On the input side of the amplifier is the voltage reference consisting of the temperature stable Zener diode (CR8) and a resistive divider network. R82 through R84 are resistors which may be selectively shorted out in order to center the potentiometer (R87) to obtain precisely 4V at the input of the amplifier. This permits the potentiometer to have small range so that the reference may be set to within 1 mV. The output voltage of the power supply is fed for comparison against the reference. A condenser, C8, stabilizes the power supply and provides a low impedance at high frequencies. In order to insure long term stability, the Zener diode is aged for several days prior to installation. If a replacement Zener is installed, the output voltage of the power supply should be checked and reset, if necessary, after a few days of operation as there is appreciable voltage change across a Zener diode during its first few hours of operation after which further voltage changes are slight and occur at a very slow rate.

APPROXIMATION CIRCUIT

The approximation circuit consists of silicon PNP transistors operated as switches and driven from the logic circuitry. In order to minimize the voltage drop across the transistors when they are conducting, transistors

corresponding to the eight most significant Binary digits are connected so that the collector serves as the emitter in the ON state. Furthermore, for the four most significant digits, a two stage switch is used with a second transistor supplying most of the current to the summing resistor. The primary switch transistor will then have little current flowing through it, thus a very small voltage drop will develop across its parasitic resistances. Each transistor switch is driven from an NPN transistor referenced to ground whose base is supplied with a signal from the logic circuitry. Resistors of very high precision are used in the most significant digits. Digits of less significance make use of resistors of somewhat less precise value.

COMPARATOR

A high gain, integrated circuit differential amplifier monitors the summing junction of the approximation circuit. The amplifier is connected so that it inverts the input signal. Since the input to the instrument must always be negative and the feedback signal from the approximation signal is positive, the comparator will have a negative output voltage if the current supplied by the approximation circuit is larger than the input current, and a positive output voltage if the current supplied by the approximation circuit is less than the input current.

LOGIC

By far the most complex portion of the logic circuitry is concerned with the commutation process. In order for the process of successive approximation to proceed in an orderly fashion, it is necessary for the logic circuits to generate control signals which successively connect to the reference voltage resistors corresponding to the most significant digit down through the least significant. Actually, this process must be repeated twice for each resistor. That is, each resistor must be connected to the reference voltage and a short time later disconnected if it is not required in the approximation. Each solid state switch is connected to the output of a JK flip-flop. The flip-flop performs two functions. First, it transfers information placed at its input to its output during, but only during, a negative transition of the clock fed to its timing input. Second, it will store information until new data is fed to it and it receives an additional clock pulse. This permits all of the set and clear inputs to the JK flip-flops in the storage section to be connected in parallel. Thus, a command to close the solid state switch may be fed to all flip-flops but only one receiving a clock pulse will respond to it. Likewise, a command to disconnect may also be fed to all of the flip-flops without affecting any but the desired one. Thus, much of the circuitry is concerned with generating pairs of pulses which occur at progressively later times during the measurement cycle.

A multivibrator serves as a clock operating at approximately 75 kHz. The output of the clock is fed into a succession of five flip-flops which divide by 32; at the end of the 32nd pulse the last flip-flop overspills, triggering a sixth flip-flop which terminates the process. A succession of AND gates and inverters are connected to the complementary outputs of the four flip-flops following the first one to provide 13 separate successive outputs, each with just one pulse occurring during the process. These are combined with the clock pulses to produce 13 separate signals each consisting of a pair of clock pulses occurring at progressively later times during the measurement cycle. These clock pulses are fed to JK flip-flops controlling the solid state switches in the approximation circuit.

During the negative transition of the first clock pulse of each pair, a signal is applied to the input of all JK flip-flops in the storage section of the unit such as to produce a switch closure. However, only one of the flip-flops is receiving a clock pulse at that time and, consequently, only one switch closes. During the second clock pulse a signal derived from the comparator is applied to the input of all JK flip-flops which causes the resistor to be disconnected during the next clock pulse if the output of the comparator is negative. If the output of the comparator is positive, this signal does not appear and the resistor remains connected. This process starts with the resistor corresponding to the overrange "1" digit and ends with the resistor corresponding to 1 in the last column. The instrument then remains dormant until a new measurement command arrives. The measurement command is a pulse applied to the preset terminals of all flip-flops which resets them to their zero state, permitting the count-down process to begin again. A one-shot multivibrator generates this pulse. A Schmitt trigger drives the one-shot multivibrator. In order to permit the system to free run, the output of the Schmitt trigger also is fed to a capacitor and from the capacitor back to the input of the Schmitt. The capacitor alternately charges and discharges between hysteresis limits of the Schmitt permitting continuous free running operation. Alternately, the Schmitt may be triggered from an external signal source at frequencies up to 1 kHz.

SECTION 6

MAINTENANCE

6.1 PERIODIC MAINTENANCE

The following maintenance should be performed once a year unless the instrument is operated in an extremely dirty or chemically contaminated environment or is subjected to severe abuse. In such cases, more frequent maintenance is indicated.

a. Blow out all accumulated dust with forced air under moderate pressure.

b. Inspect the instrument for loose wires and damaged components. Check to see that all plug-in PC boards are properly seated in their sockets and that all wire lead connectors are properly seated on their PC board pins.

c. Make a performance check in accordance with the procedure of Section 4. If the performance is within specifications no further service is indicated.

6.2 INTERNAL ADJUSTMENTS AND TEST POINTS

The following is a list of adjustments and test points supplied for ready reference. Do not attempt to make any adjustments until you have carefully read the material in Section 6.3.

6.2.1 DESCRIPTION OF ADJUSTMENTS

The function of each adjustment is described below.

a. A1R9 +12.6 V POWER SUPPLY CALIBRATION ADJUSTMENT. Used to set the positive power supply to +12.6 V within ±10 mV.

b. A1R18, -12.6 V POWER SUPPLY CALIBRATION ADJUSTMENT. Used to set the negative power supply to -12.6 V within +10 mV.

c. A2R32, AVERAGING CIRCUIT BALANCE. Used to set the voltage at A2J3 to zero with A2J1 shorted to A2J2.

d. A3R2, POSITIVE AMPLIFIER BALANCE ADJUSTMENT. Used to adjust the positive amplifier to zero V output with its input shorted.

e. A3R12, NEGATIVE AMPLIFIER BALANCE ADJUSTMENT. Used to adjust the negative input amplifier to give zero V output with input shorted.

f. A4R7, LOG/LIN AMPLIFIER BALANCE ADJUSTMENT. Used to adjust the voltage at A4J1, to zero V ±1 mV.

g. A4R9, LOG CALIBRATION FACTOR ADJUSTMENT. Used to set the log calibration factor so that the digital display changes by exactly 1 dB as the calibration factor control is turned from zero to +1 dB.

h. A4R12, 40 mV/dB ADJUSTMENT. Used to set the voltage at A4J2 so that it changes 400 mV ±4 mV for each 10 dB change in input signal level.

i. A4R32, dBm CALIBRATION ADJUSTMENT. Used to set the digital display to read 10.0 dBm for 10 mW input to the detector.

j. A4R38, dB OVERRANGE ADJUSTMENT. Used to set the overrange indicator to light with 11 mW supplied to the detector.

k. A4R60, COARSE BALANCE ADJUSTMENT. Used to adjust the isolation amplifier between the high speed sampler and the data hold circuit so that with no RF input to the detector 0 V is obtained at A4J7.

l. A4R86, COMPENSATION AMPLIFIER BALANCE ADJUSTMENT. Used to adjust the balance of the compensation amplifier so that with no RF input to the detector, 0 V is measured at A4J10.

m. A4R98, CALIBRATION CENTERING ADJUSTMENT. Used to bring the +10 dBm CAL control on the front panel to the center of its range.

n. A4R101, COMPENSATION AMPLIFIER GAIN ADJUSTMENT. Used to adjust the gain of the compensation amplifier so that the degree of compensation required for the characteristics of detector diode used will fall within the adjustment range of the shaping network.

o. A4R104 through A4R128, DIODE LAW COMPENSATION ADJUSTMENTS. These adjustments are used to set the tracking of the instrument from -20 through +10 dBm.

p. A4R160, INPUT ZERO ADJUSTMENT. Used to set the preamplifier output, A4J6 to 0 V with no RF input to the detector.

q. A6R69, DELAY CALIBRATION ADJUSTMENT. Used to set the sampling pulse delay to be 100 µS with the TRIGGER DELAY knob set to 99.99.

r. A6R78, DELAY ZERO ADJUSTMENT. Used

to adjust the delay circuit for proper operation when the TRIGGER DELAY control is set to 0.00.

s. A7R3, ZERO SET ADJUSTMENT. Used to set the display to read zero with its input shorted.

t. A7R87, +4.000 V ADJUSTMENT. Used to set the reference supply to +4.000 V ±1 mV.

u. A8C2, OSCILLATOR FREQUENCY. Used to set the calibrator frequency to 105 MHz ±1 MHz.

v. A8C16, CALIBRATOR AMPLIFIER TUNING. Used to set the output amplifier of the calibrator circuit to draw the minimum current.

w. A9R22, PREAMPLIFIER GAIN ADJUSTMENT. Used to adjust the preamplifier to give 4 V output for 10 mW RF input to the detector. Measure at A4J6.

x. A9R21, PREAMPLIFIER RESPONSE ADJUSTMENT. Used to adjust the preamplifier for proper pulse response.

y. R13, dB OFFSET. Used to set the dB offset to add 20.0 dB to the dB reading when the 20 dB COUPLER button is pushed.

6.2.2 DESCRIPTION OF TEST POINTS.

a. A1J1, +12.6 V. Measure between A1J1 and common, A1J2. The dc voltage should be +12.6 V ±10 mV.

b. A1J2, COMMON LINE.

c. A1J3, -12.6 V. Measure between A1J3 and common, A1J2. The dc voltage should be -12.6 V ±10 mV.

d. A2J1, AVERAGING CIRCUIT INPUT. May be shorted to A2J2 for setting A2R32.

e. A2J2, AVERAGING CIRCUIT COMMON.

f. A2J3, AVERAGING CIRCUIT OUTPUT. Measure between A2J3 and A2J2; set A2R32 to obtain 0 V ±1 mV.

g. A3J1, ABSOLUTE VALUE CIRCUIT OUTPUT. Used to check for proper operation of the absolute value circuit.

h. A3J2, DISPLAY PREAMPLIFIER OUTPUT. With the display preamplifier input shorted, set to 0 V ±0.5 mV using the minus balance adjustment, A3R12.

i. A4J1, LOG/LIN AMPLIFIER SUMMING JUNCTION. Measure between TP41 and TP43 and set A4R7 for 0 V ±1 mV.

j. A4J2, LOG POST AMPLIFIER OUTPUT. Measure between A4J2 and A4J3 and adjust A4R12 for 40 mV ±0.4 mV/dB.

k. A4J3, INPUT CIRCUIT COMMON.

l. A4J4, LOG TRANSISTOR VOLTAGE. Used to check the operation of the logging circuit.

m. A4J5, OVEN CURRENT MONITOR. Measure between A4J5 and A1J3. Voltage should be approximately 2 V immediately after turn-on and settle to less than 0.6 V within five minutes.

n. A4J6, PREAMPLIFIER OUTPUT. Used to check the output level and the pulse response of the preamplifier.

o. A4J7, SAMPLE-HOLD ISOLATION AMPLIFIER OUTPUT. Measure between A4J7 and A4J3; adjust A4R60 to obtain 0 V ±1 mV.

p. A4J8, COMPENSATION AMPLIFIER OUTPUT. Measure between A4J10 and A4J3; adjust A4R86 for 0 V ±1 mV.

q. A4J9, CHOPPER DEMODULATOR OUTPUT. Measure between A4J9 and A4J3, using an oscilloscope. At the time the demodulator switch is closed, the voltage waveform should be 0 V. When the demodulator switch is open noise should be present, magnitude of approximately 0.05 V P-P.

r. A4J10, SAMPLING PULSE. Measure between A4J10 and A4J3. Pulse is 80 nS going from -12 V to +5 V.

s. A4J11, HOLD-CIRCUIT DRIVE PULSE. Measure between A4J11 and A4J3. Pulse is 10µS long, going from -12 V to +5 V.

t. A6J1, +5 VOLT LOGIC SUPPLY. Measure between A6J1 and A6J2. Supply should be +5 V ±0.2 V.

u. A6J2, TRIGGER CIRCUIT COMMON.

v. A7J1, DIGITAL DISPLAY INPUT.

w. A7J2, DIGITAL DISPLAY COMMON.

x. A7J3, +3.6 V. Measure between A7J3 and A7J2, +3.6 V ±100 mV.

y. A7J4, +4.000 V. Measure between A7J4 and A7J3. +4.000 V ±1 mV. Ripple less than 0.5 mV P-P at 115 Vac line.

z. A7J5, CLEAR LINE. Used to provide a trigger source for an oscilloscope when checking the logic circuits. Also indicates proper operation of the frequency divider.

aa. A7J6, PRESET LINE. Used to check for proper operation of the preset one-shot multivibrator.

bb. A7J7, SET LINE. Used to check for proper operation of the comparator.

cc. A8J1, +12.6 V INPUT TO CALIBRATOR.

dd. A8J2, CALIBRATOR OUTPUT AMPLIFIER CURRENT. Measure between A8J1 and A8J2 which measures the voltage across 10 ohm monitor resistor. Adjust A8C16 for minimum current.

ee. A8J3, CALIBRATOR AMPLIFIER OUTPUT.

ff. A8J4, CALIBRATOR OUTPUT GROUND.

gg. A8J5, CALIBRATOR CONTROL AMPLIFIER OUTPUT. Measure between A8J5 and A8J7; indicates magnitude of base drive to amplifier.

hh. A8J6, CALIBRATOR DETECTOR OUTPUT. Measure between A8J6 and A8J7; monitors detector voltage.

ii. A8J7, CALIBRATOR COMMON.

6.3 CALIBRATION

6.3.1 EQUIPMENT REQUIRED FOR CALIBRATION.

a. A 4 digit +50% overrange Digital Voltmeter with 100 µV per digit minimum resolution on its most sensitive range.

b. A sensitive dc Voltmeter with at least 10 µV minimum resolution. An instrument with a full-scale range of 1 mV and a 5" scale will be adequate if the zero stability is good enough to permit measurements within 1 minor division of zero.

c. A precision power supply with at least 5 digit resolution. Maximum voltage 10 V. Accuracy 0.01%.

d. A precision power bridge and thermistor mount. The thermistor mount must have its calibration factor known to within 1% at 100 MHz. The bridge must contribute less than 0.5% error to the measurement at 10 mW.

e. A precisely calibrated step attenuator with excellent repeatability of attenuation, or a set of fixed attenuators. The calibration data should be accurate to 0.02 dB/10 dB, over 30 dB range. If separate attenuators are used, the calibration data should be accurate to 0.02 dB/10 dB for each unit individually and in combination with the others over the range from 0 dB to 30 dB in 1 dB increments.

f. A frequency Counter/Time Interval Meter with counting capability to 125 MHz. The time interval function must have separate start and stop inputs and a minimum resolution of 100 nS.

g. A Pulse Generator capable of supplying a 0.5 µS pulse with a repetition rate of 500 Hz. Amplitude capability to 1 V into 50Ω and 2 V into an open circuit. Maximum rise-time of 10 nS.

h. An oscilloscope with 10 nS maximum rise-time and 50 mV vertical sensitivity. An accessory X10 probe with less than 10 pF loading capacity is required.

6.3.2 CALIBRATION PROCEDURE

The Model 1018A employs solid state components exclusively. These are extremely reliable and generate little heat; consequently, there is little drift due to component aging, and adjustments to the instrument are rarely required. We therefore strongly recommend that if measurements indicate that an adjustment is set within the stated range that you do not attempt to put it "right on". It is often the case that variations in the equipment used to test the instrument account for small differences in measured values. Other adjustments that depend upon a given adjustment will be effected if it is reset. In short, BE ABSOLUTELY SURE THAN AN ADJUSTMENT IS REALLY REQUIRED BEFORE MAKING IT.

If a component is replaced, depending upon where in the circuit it is located, only certain of the calibration steps need be performed. In general, only those steps shown in the section pertaining to the specific circuit repaired need be carried out.

6.3.2.1 POWER SUPPLIES

a. Connect the digital voltmeter between A1J3 and A1J2. Adjust A1R18 to obtain -12.6 V ±10 mV.

b. Remove the voltmeter probe from A1J3 and move it to A1J1. Adjust A1R9 to obtain +12.6 V ±10 mV.

6.3.2.2 DIGITAL DISPLAY

a. Set the TRIGGER SELECTOR switch to FREE RUN and the PULSE AVERAGING switch to ON MAX RESET. Check the 3.6 V supply. Measure between A7J3 and A7J2. The voltage must be 3.6 V ±200 mV.

b. Adjust the 4 V supply. Adjust the voltage

between A7J4 and A7J2 to be 4 000 V ±1 mV by adjusting A7R87.

c. Adjust the digital display to zero. Disconnect the output of the preamplifier board by removing the lead from Terminal A7-15.

CAUTION

BE VERY CAREFUL TO GRASP THE METAL PORTION OF THE JACK WITH A PAIR OF PLIERS. DO NOT PULL ON THE WIRE.

Connect the positive side of the precision power supply to A7J2 and the negative side to Terminal A7-15. Adjust A7R3 until the transition from zero to 1 occurs between 2 and 3 mV. Now check to see that the transition between 1 and 2 occurs between 5 and 6 mV. If necessary, readjust A7R3. When A7R3 is properly set, both transitions will occur as indicated. Disconnect the precision supply and reconnect the output of the preamplifier to Terminal A7-15.

d. Disconnect the lead to the digital display preamplifier at Terminal A4-36. Connect the negative terminal of the precision supply to this lead. Connect the positive terminal of the precision supply to ground at A4J3. Adjust A3R12 until the transition between 0 and 1 occurs between 2 and 3 mV. Check to see that the transition between 1 and 2 occurs between 5 and 6 mV. Readjust A3R12 if necessary, so that both transitions occur as required.

e. Reverse the polarity of the precision supply and adjust A3R2 using the procedure of Section d. Disconnect the power supply and replace the lead on Terminal A4-36.

6.3.2.3 CALIBRATOR

a. Connect the counter to the calibrator output and measure the calibrator frequency. The frequency should be in the range from 103 to 107 MHz. If the frequency is in the correct range, no adjustment is required. If it is beyond this range, it will be necessary to remove the calibrator from the instrument and remove the top cover to obtain access to the frequency adjusting capacitor A8C2. With the counter connected to the output, adjust A8C2 to obtain 105 MHz. Connect the voltmeter between A8J1 and the negative side to A8J2. Adjust A8C16 to obtain minimum current. Recheck the frequency and, if necessary, readjust it and repeat the current level adjustment.

b. Connect the detector of the precision power bridge to the calibrator output and adjust the calibrator output level to be 10 mW as closely as possible using the small screwdriver inserted through the rear panel adjusting hole.

6.3.2.4 TRIGGER CIRCUIT

a. Set the TRIGGER selector switch to EXT., the PULSE AVERAGING switch to ON MAX RESET and the TRIGGER DELAY to 00.0 µS. Adjust the pulse generator to give a positive 0.5 µS pulse at a 500 Hz repetition rate. Set the pulse amplitude to 2 V. Connect the pulse generator output to the TRIGGER input on the Model 1018A, the vertical input of the oscilloscope and to the external trigger input of the scope, using Tee connectors. Keep the length of cable between the external trigger input and the vertical input to a minimum. Connect a length of cable to the rear-panel REFERENCE PULSE output long enough to reach to the input of the scope.

b. Set the oscilloscope sweep to 0.1 µS/DIV, the trigger selector to external and adjust the display so that the rising edge of the pulse is 1 division in from the left edge. Remove the connection from the pulse generator to the vertical input but do not disturb the trigger connection. Connect the cable from the REFERENCE PULSE in its place. Set the vertical sensitivity to 0.5 V/DIV; you should see an 80 nS pulse.

c. Adjust A6R78 (DELAY ZERO) so that the trailing edge 50% point is at the third division in from the left edge of the display graticule. Thus the delay from the rising edge of the trigger pulse to the trailing edge of the reference pulse is 200 nS.

d. Remove the trigger cable from the oscilloscope and connect it to the "start" input of the Counter/Time Interval Meter. Connect the Reference Pulse to the "stop" input of the Counter. Set the TRIGGER DELAY control to 100 µS (the "1" will not show in the window and the dial will read 00.0 and be near the clockwise end of its travel). Set the counter to have 100 nS resolution in the Time Interval mode with the slope set to "+".

e. Adjust A6R69 (DELAY CAL) to obtain a reading of 100.1 µS. This allows for the approximately 100 nS delay between the rising edge of the trigger pulse and the rising edge of the reference pulse.

6.3.2.5 INPUT CIRCUIT

The following checks and adjustments must be made with utmost care. Before making any adjustments, carefully read this entire section. Adjustments must

be made in the order indicated.

a. Connect the power detector to the CALIBRATOR OUTPUT. Set the front panel controls as follows:

PULSE AVERAGING	ON MAX RESET
TRIGGER	FREE RUN
CAL FACTOR	0
CALIBRATOR	OFF
RANGE	10 mW DIRECT
DELAY	10 µS
-20 dBm CAL	Center of range
+10 dBm CAL	Center of range

b. Connect the sensitive voltmeter between A4J6 and A4J3 (common). Adjust A4R160 for a reading of 0 V as closely as possible. The reading should be within 20 µV of zero when adjusted properly.

c. Connect the digital voltmeter to A4J6 with the low side connected to A4J3. Turn the calibrator to +10 dBm. The reading should be 4.0 V ±40 mV. If it is not, adjust A9R22 to obtain 4.0 V as closely as possible. To gain access to the adjustment in the detector head assembly (A9), remove the two screws at the rear of the assembly, slide the retaining cap up the cable and grasp cylindrical outer cover and slide it back.

d. Set the pulse generator to give a 1 µS pulse at a repetition rate of 500 Hz. Using the oscilloscope to monitor the pulse, adjust the amplitude to be 0.5 V negative when terminated in 50Ω. Remember, a pulse of amplitude greater than 1.5 V may damage the detector. Now connect the detector to the output of the pulse generator and connect the oscilloscope (using a X10 probe) to A4J6 with the common (ground) lead of the scope connected to A4J3. Use a short ground lead as the pulse has a rather rapid rise. Adjust A9R21 to obtain an overshoot-free response with the best rise-time.

e. Turn the calibrator off and connect the sensitive voltmeter to A4J7 and A4J3 (common). Adjust A4R60 to obtain 0 V as closely as possible.

f. Move the voltmeter to A4J8 and adjust A4R86 to obtain 0 V as closely as possible.

g. Disconnect the voltmeter from the instrument and turn the unit so that it is sitting on its right side. Working from the underside of the instrument connect the common side of the voltmeter to A2J2 and the high side to A2J3. Board A2 is fastened to the right side gusset. Adjust A2R32 to obtain 0 V as closely as possible. Remove the voltmeter and return from board A4.

h. Connect the voltmeter to A4J1 and the common side to A4J3. Adjust A4R7 to obtain 0 V as closely as possible.

i. Disconnect the wire from Terminal A4-39. Connect the + output of the precision supply to A4J1 and the low side to A4J3 (common). Press the +10 dBm button and set the supply to 2.000 V. Note the reading on the display. Set the supply to 0.200 V and then to 0.020 V. Each step should cause the display to change by 10.0 dB; adjust A4R12 to obtain this action. If, after adjusting A4R12, the change from 0.200 V to 0.020 V does not match the change from 2.000 V to 0.200 V, repeat step h and readjust A4R12. Reconnect the wire to Terminal A4-39.

j. Set the precision supply to the voltage which causes the display to read 0.0 dBm. This can be set very closely by noting when the display switches from + to -. Turn the CAL FACTOR lever switch to + and the rotary switch to 1.0 dB. Adjust A4R9 so that the display reads +1.0 dBm. Move the lever to - and check to see that the display reads -1.0 dBm. If necessary, readjust A4R9 so that both + and - settings read correctly.

k. Connect 10 dB of attenuation between the output of the calibrator and the detector, turn the calibrator on and set the CAL FACTOR switch to compensate for the attenuator calibration difference from 10 dB. Adjust A4R98 so that the display reads 1.000 on the 1 mW range. Add an additional 10 dB of attenuation and note the reading. Remove the additional 10 dB and set A4R101 to cause the reading to be above or below 1 mW by twice the amount the reading with the attenuator was above or below .100 mW. For example, if the reading at 100 µW was 0.105, then the reading at 1 mW should be set to be 1.010.

   Now readjust A4R98 so that the display reads 1.000 mW and repeat the procedure. Continue until the display agrees at both 100 µW and 1 mW. The final adjustment will have to be made using the 100 µW range and the 1 mW range, and readings obtained must take into account the calibration of the attenuator used to go between 1 mW and 100 µW.

l. In order to complete the measurements of and

adjustments to the tracking controls it is necessary to have a table of readings to be expected from the Model 1018A as attenuation is inserted between the calibrator and the detector. The attenuation starts from 20 dB and is reduced in 1 dB steps to 0. It is required to make adjustments in the linear mode to take advantage of the maximum resolution available from the instrument. Therefore, you must multiply the linear calibration correction factor to each attenuation amount. For your reference a chart, shown in Table 6-1, converting dB corrections to linear is provided below. In addition, a chart, Table 6-2, showing uncorrected expected readings is provided with additional space allowed for you to write in the corrected values. You are urged to make a photocopy of the chart, write in the corrected readings and file it where it will be available along with the calibrated attenuator.

m. Using the 1 mW scale, check the tracking from 100 µW to 1 mW. If necessary, adjust resistors A4R104 through A4R112 (adjustments A through E) to obtain proper tracking (within 1%). Start by adjusting A4R104 at the lowest input level and working up to A4R112 at successively higher levels. Do not move the adjustments much the first time through; repeat the procedure several times until the readings fall where they should. It is often the case that no adjustment is required, even when a new detector diode is installed as tracking at these levels is quite consistent from detector to detector. If a large adjustment is required it will be necessary to readjust A4R86, A4R98 and A4R101; see Sections f and k.

n. Using the 10 mW scale, check the tracking from 1 mW to 10 mW. If required, corrections can be made using adjustments f through m. Proceed from the lowest input, adjust A4R114 and work up to the highest input and adjust successively higher numbered resistors. Repeat the procedure as required to obtain the best tracking. When finished, the values obtained should be within 1% of the desired

TABLE 6-1

ATTENUATOR CORRECTION FACTORS

CORRECTION FACTOR (dB)	LINEAR EQUIVALENT	
	+	-
.01	1.0023	.9977
.02	1.0046	.9954
.03	1.0069	.9931
.04	1.0093	.9908
.05	1.0115	.9886
.06	1.0139	.9863
.07	1.0162	.9840
.08	1.0186	.9817
.09	1.0209	.9795
.10	1.0233	.9772
.11	1.0257	.9750
.12	1.0280	.9727
.13	1.0304	.9705
.14	1.0328	.9683
.15	1.0351	.9660
.16	1.0375	.9638
.17	1.0399	.9616
.18	1.0423	.9594
.19	1.0447	.9572
.20	1.0471	.9550
.21	1.0495	.9528
.22	1.0520	.9506
.23	1.0544	.9484
.24	1.0568	.9462
.25	1.0593	.9440
.26	1.0617	.9419
.27	1.0641	.9397
.28	1.0666	.9375
.29	1.0691	.9354
.30	1.0715	.9332

TABLE 6-2

DISPLAY READINGS WITH ATTENUATION BETWEEN CALIBRATOR AND DETECTOR

ATTENUATOR LOSS (dB)	READING (mW)	CORRECTED READING
20	100.0 µW	
19	.1259	
18	.1585	
17	.1995	
16	.2512	
15	.3162	
14	.3931	
13	.5012	
12	.6310	
11	.7943	
10	1.000	
9	1.259	
8	1.585	
7	1.995	
6	2.512	
5	3.162	
4	3.931	
3	5.012	
2	6.310	
1	7.943	
0	10.00	

values. It may be required to have a given reading set slightly high or low to compensate for the next reading above or below a given input level. Also, you may find it useful to periodically reset the +10 dBm CAL adjustment on the front panel as the process goes on.

o. Connect the detector directly to the calibrator and adjust the +10 dBm CAL control to cause the instrument to read 10.00 mW as closely as possible. Press the +10 dBm button and adjust A4R17 so that the display reads +10.0 dBm.

p. Press the 20 dB coupler button and adjust R13 so that the display reads 30.0 dB.

q. Connect the precision supply + lead to A4J1 and the common lead to A4J3. Set the supply to cause the display to read +10.5 dBm and adjust A4R38 to the point where the OVER-RANGE light just comes on.

This completes the calibration procedure.

6.4 DETECTOR MAINTENANCE

CAUTION

The detector element mounted in the detector body (see Figure 6-1) can be damaged if the special handling precautions noted below are not observed. Before removing, installing, or handling the detector element in any way, be sure to read the precautions below.

6.4.1 DETECTOR ELEMENT HANDLING PRECAUTIONS

a. Before installing a detector element into the detector mount, discharge any static voltages that may exist between yourself and the mount by touching the mount.

b. When handing a detector element to another person, discharge static voltage by touching hands before passing the element.

c. Do not use ohmmeters to check the detector elements since the voltages and currents available from most such meters can easily damage the sensitive diodes used in these elements.

6.4.2 REPLACING THE DETECTOR ELEMENT

Refer to Figure 6-1 for identification of the parts mentioned in this procedure.

a. Unscrew the preamplifier assembly from the body. In separating these parts use a pair of pliers with plastic jaws or protect the parts with heavy paper or tape.

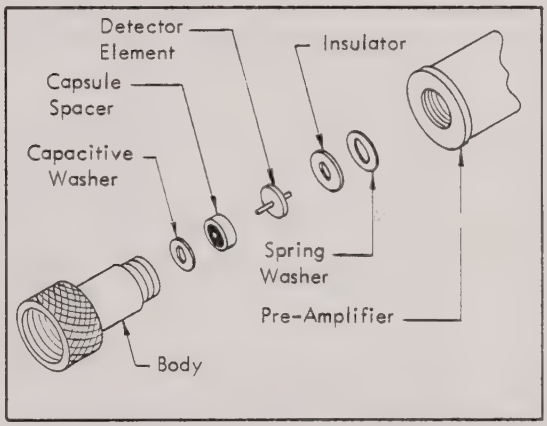
b. Remove and discard the old detector element, capsule spacer, and capacitive washer. Do not discard the insulator or spring washer.

c. Install the new capacitive washer, capsule spacer, detector element and the original insulator and spring washer in that order. Note that the polyiron side of the capsule washer should be against the capacitive washer. Insert the resistive end of the detector element into the center contact inside the body.

CAUTION

When inserting the detector element, do not force the tip (resistive end) into the center conductor in the body as the fingers of the center conductor may be damaged.

d. Replace the preamplifier assembly and tighten firmly.



DETECTOR
FIGURE 6-1

6.5 TROUBLE SHOOTING

In order to localize the source of trouble in an instrument such as this, it is necessary to have a rather detailed working knowledge of the instrument. You are urged to read carefully Section 5 on Circuit Description and make use of the circuit diagrams.

6.5.1 LOCALIZATION OF TROUBLE

Use Trouble Shooting Table 6-3. Also make use of the test point information in Section 6.2.

After the trouble has been found and corrected, the calibration should be checked as outlined in Section 6.3.

TABLE 6-3 TROUBLE SHOOTING

INDICATION	CHECK
NO DIGITAL DISPLAY	1. Power Cord. 2. Fuse (F1); F1 is 0.5 A 250 V. 3. POWER switch, S1. 4. Transformer, T1. 5. 200 V power supply
DIGITAL DISPLAY DOES NOT CHANGE	1. Digital display board, A7. 2. Trigger selector set to wrong position. 3. Display rate set to EXT. 4. Trigger circuit, A6.
INSTRUMENT PROVIDES MEANINGLESS DISPLAY WITH SEVERAL NUMBERS LIT IN EACH DISPLAY TUBE.	1. Check that the 3.6 V supply is operating A7J3. 2. Check the logic circuit. Determine that there are 16 pulses at A7J5 each measurement cycle. Look for pairs of pulses at Pins 2 and 6 of A7QA14 through A7QA19 and at Pin 2 of A7QA20. When checking for logic levels within the instrument, it will be found that they vary considerably from IC to IC. The following levels are limits of operation. a. A low level input may not exceed 400 mV. b. A high level signal may not fall below 800 mV.
OUT OF CALIBRATION ON BOTH LINEAR AND LOG MODES.	1. Detector. 2. Power supplies, A1. 3. Input amplifier, A4J6. 4. Sample-and-hold circuits and shaper amplifier on A4. 5. Output amplifiers on A4.
OUT OF CALIBRATION ON LOG MODES.	1. Oven, A4J5. 2. Log output amplifier, A4QA2 and associated circuitry.
CANNOT BE CALIBRATED AT -20 dBm.	1. Chopper amplifier, A2.
LARGE CHANGE IN READING WITH CHANGES IN DISPLAY RATE.	1. Sample-and-hold circuits on A4.

6.5.2 LOCALIZATION OF TROUBLE TO INDIVIDUAL COMPONENTS

To determine whether a component is defective, it may be necessary to make active or passive circuit checks, as well as waveform measurements. Where allowed by circuit voltages, the performance of a transistor that is forward-biased can usually be determined by shorting the base to the emitter or by opening the base circuit. The transistor will be turned off in either case unless it is shorted. Performance may be determined by monitoring circuit parameters. A transistor can be assumed to be open if it does not conduct when its base-to-emitter voltage exceeds turn on.

When checking the FET's used in the Model 1018A, shorting the source to gate will result in turn on unless the FET is open. Under normal operating conditions these FET's operate with a negative bias of less than 2 V between the gate and source and a source to drain voltage of at least 5 V unless the unit is shorted. Ohmmeter measurements may be made on the source-gate junction as long as the precautions mentioned below are observed. Back biased, the source-gate junction should be essentially open.

Open or shorted transistors may also be located through resistance measurements across the elements. Exact values cannot be given due to the differences in transistors; however, the ratio of forward and backward emitter-collector resistance is normally between 10:1 and 100:1. Higher power transistors have the lower ratios. If it is determined that a transistor is defective, look for other defective elements in the circuit that may have resulted from, or caused the transistor failure.

When checking resistors and capacitors, one lead should be disconnected to prevent shunt paths and possible damage to diodes and transistors.

CAUTION

1. USE OF OHMMETER. Some ohmmeters may supply sufficient voltage or current to damage transistors. Before using an ohmmeter to check transistors or to make measurements in transistor circuits, be sure to check the voltage and current output of the ohmmeter on the range to be used. The open circuit voltage should not exceed 1.5 V and the short circuit current should not exceed 3 mA or transistors may be damaged. Never use an ohmmeter to check the detector diode. The only safe way to check the detector is to measure the voltage on TP18 (A4J8) with RF input into the detector.

2. MEASURING TRANSISTOR VOLTAGE. Do not measure the base-to-emitter voltage of a transistor directly because auxiliary currents may damage the transistor. Measure the voltage independently with respect to ground.

6.6 PARTS REPLACEMENT

6.6.1 REPLACEMENT OF PARTS ON PRINTED CIRCUIT BOARDS

Before removing a component from a PC board, carefully note its orientation. Apply heat sparingly to the component lead. Be sure that the soldering iron is grounded to prevent leakage current from damaging the other components. The simplest way to remove a component with three or more leads is to cut the leads and then unsolder the remaining leads from the PC board. Clear the solder from the PC board holes with a toothpick or an awl for ease of insertion of the new component. To replace the component, form and cut the leads so that they extend approximately 1/16" through the PC board when the component is in position. Whenever possible hold the component lead with a tool that will act as a heat sink and solder the lead from the opposite side. Avoid overheating and use a good quality rosin core solder. Cut off excess lead length and clean off any excess flux.

A break in the etched copper conductor may be repaired by soldering a piece of copper wire across the break. If the bond between the etched copper conductor and the base material fails, secure the conductor in place with a cement having good electrical insulating properties.

6.6.2 REPLACEMENT OF PARTS ON THE FRONT PANEL

To replace the parts mounted on the front panel remove the screws indicated in Figure 6-2. Carefully pull the panel straight out from the rest of the instrument. When reassembling the panel to the instrument use care to be sure that all switches come through their slots properly and that no wires are pinched between mating sheet metal parts.

6.6.3 REMOVING PLUG-IN PRINTED CIRCUIT BOARDS

The upper portion of the rear panel serves as a hold-down for the plug-in printed circuit boards. Access to these circuit boards is gained by removing the top cover and the upper portion of the rear panel.

6.6.4 INDICATOR TUBE REPLACEMENT

Access to the indicator tubes is obtained by removing the front panel as described in Section 6.6.2.

6.6.5 UNIT LAMP REPLACEMENT

Remove the top cover to expose the digital display assembly. The unit assembly may be removed from the

assembly by taking out the two nuts that hold it to the shadow box enclosing the display tubes. Carefully pry the plastic lens off the lamp holder with the defective bulb. Use your fingernail, small screwdriver or knife blade to separate the lens from the rest of the assembly. Pull the lamp straight out of the holder. The replacement lamp will normally have leads too long to fit the holder; use the old lamp as a pattern and cut the leads to fit. Push in the new lamp, snap the lens on and replace the assembly in the shadow box.

6.6.6 REMOVAL OF THE CALIBRATOR

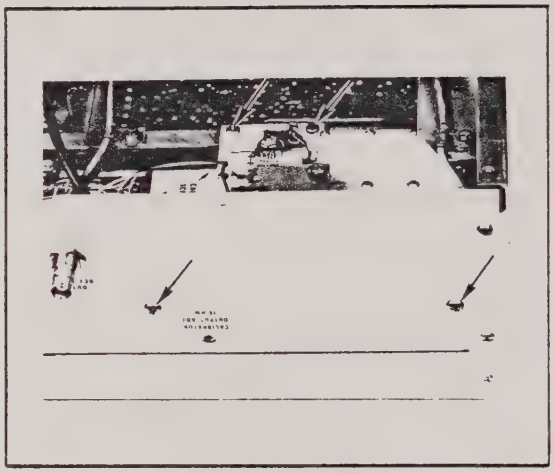
The calibrator assembly is fastened to the rear of the instrument by several screws. Refer to Figure 6-3 to determine which screws need to be removed. You should NOT remove any screws not required in the removal procedure.

6.6.7 SEMICONDUCTOR DEVICES

A variety of semiconductor devices is used in this instrument. The type numbers shown are either EIA registered numbers or manufacturer's numbers and these devices may be used for replacement purposes. Individual instruments may have equivalent devices of other manufacturers installed and the type number may not agree with those shown.

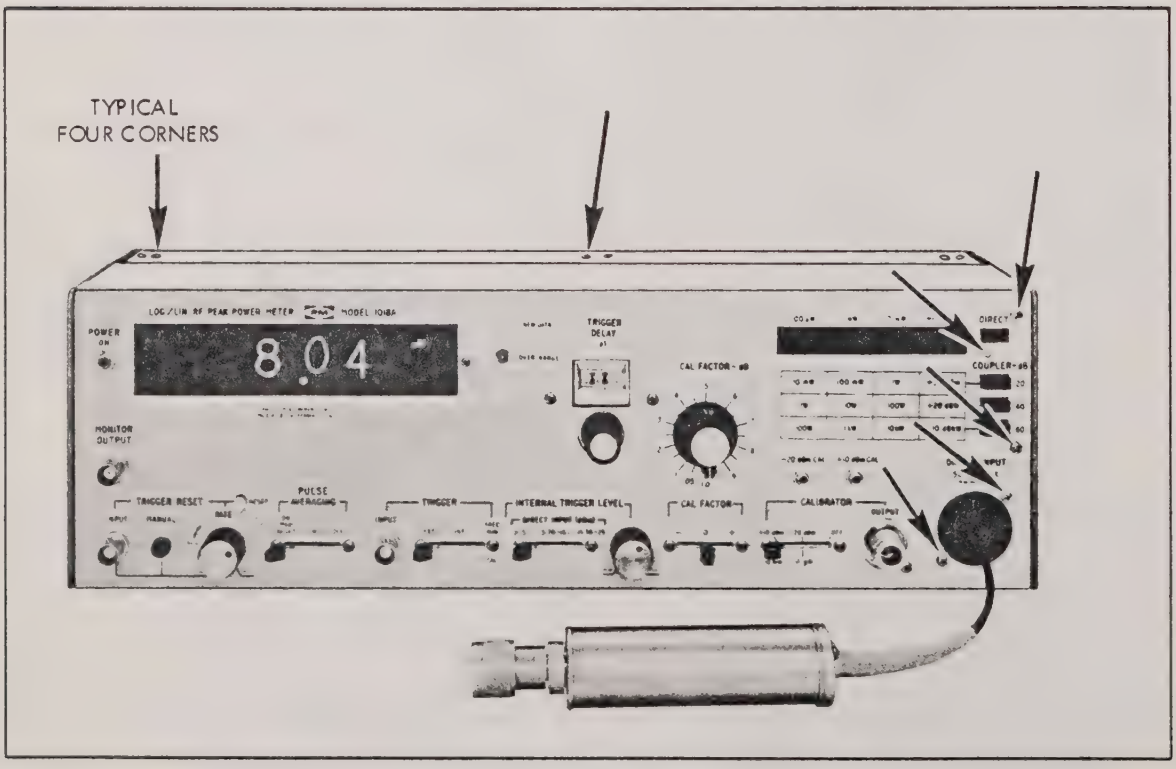
6.6.8 ACCESS TO RANGE SWITCH PC (A2)

To gain access to the back of the Range Switch PC board it is necessary to release the panel as indicated in paragraph 6.6.2 and remove the three screws that secure the PC board to the side of the chassis.



CALIBRATOR MOUNTING SCREWS

FIGURE 6-3



FRONT PANEL MOUNTING SCREWS

FIGURE 6-2

6.7 WIRE LIST

See Table 6-4.

TABLE 6-4

J4(A1) POWER SUPPLY

FROM	TO	COLOR	COMMENT
-	Assy 12211-5	BLK-GRN	50Ω Coax Outer Conductor
J4-1	Q1-B	WHT-BLU	+12.6V Pass Transistor
J4-2	Q1-E	WHT-RED	+12.6V (TB3-3 & 4)
J4-3	T1-9	WHT-GRN	
J4-4	T1-10	WHT-GRN	
J4-8	TB2-3	BUS	Common 1
J4-9	TB3-2	BUS	-12.6V
J4-13	Q2-B	WHT-GRN	-12.6V Pass Transistor

A2 (Assembly 12047) RANGE SWITCH & LAMP DRIVERS

FROM	TO	COLOR	COMMENT
-	Assy 12211-5	BLK-GRN	50Ω Coax Outer Conductor
A2-1	TB3-1,2	WHT-PRP	-12.6V
A2-2	TB3-3,4	WHT-RED	+12.6V
A2-3	TB2-3,4	WHT-BLK	Common 1
A2-4	A4-39	WHT-BLU	
A2-5	C2	BLK-GRN	Assembly 12211-2 50Ω Coax Inner Conductor
A2-6	A5-17	WHT-YEL-GRN	Raw +3.6V Supply
A2-7	DS2	WHT-GRA	mW
A2-8	DS1	WHT	μW
A2-9	TB2-1,2	WHT-BLK	Common 2
A2-10	A4-35	WHT-YEL-ORN	
A2-11	A4-30	WHT-GRN	
A2-12	A4-27	WHT-BLU	
A2-13	A4-31	WHT-ORN	
A2-14	A4-26	WHT-GRA	
A2-15	A4-32	WHT-BLU	
A2-16	A7-11	WHT-GRN	Decimal 10^{-1}
A2-17	A4-28	WHT-BRN	
A2-18	A4-29	WHT-YEL-RED	
A2-19	A4-25	WHT-YEL-GRN	
A2-20	A7-12	WHT-YEL	Decimal 10^{-2}
A2-21	A7-13	WHT-YEL-PRP	Decimal 10^{-3}
A2-22	A4-38	WHT-BRN	
A2-23	DS4	WHT-YEL	dB
A2-24	A7-9	WHT	Polarity On-Off
A2-25	DS9	WHT-BLU	KW
A2-26	DS3	WHT-BRN	W
A2-27	R1-CW	BLK-YEL	Inner Conductor 50Ω Co-Ax
A2-28	--	BLK-YEL	Outer Conductor 50Ω Co-Ax

TABLE 6-4 (Cont)

A2-29	A6-9	WHT-YEL-RED	
A2-30	Q4,R11	WHT-YEL-GRN	Assembly 12211-4

J5(A3) PREAMP & POLARITY

FROM	TO	COLOR	COMMENT
J5-2	TB3-3,4	WHT-RED	+12.6V
J5-3	A7-15	WHT-YEL	Output/Input
J5-5	A4-36	WHT	Input/Output
J5-8	TB2-3,4	WHT-BLK	Common 1
J5-9	TB3-1,2	WHT-PRP	-12.6V
J5-12	Q3-E	WHT-YEL-RED	+3.6V
J5-13	A7-10	WHT-ORN	Polarity
J5-14	TB2-1,2	WHT-BLK	Common 2
J5-15	A7-19	WHT-GRN	Print Command

A4 (Assembly 12042) INPUT CIRCUIT

FROM	TO	COLOR	COMMENT
A4-1	A5-9	WHT-YEL-GRN	+150V
A4-2	R1-Arm	BLK	Inner Conductor 50Ω Co-Ax
A4-3	--	BLK	Outer Conductor 50Ω Co-Ax
A4-4	R3-Arm	WHT-BLU	
A4-5	S3	BLK-ORN	Inner Conductor 50Ω Co-Ax
A4-6	R6,R8	BLK-ORN	Outer Conductor 50Ω Co-Ax
A4-7	RB3-1,2	WHT-PRP	-12.6V
A4-8	TB3-3,4	WHT-RED	+12.6V
A4-9	A9-1	RED	+12.6V
A4-10	A9-4	BLU	-12.6V
A4-11	A9-7	WHT	Common 1 & Outer Conductor 50Ω Co-Ax
A4-12	A9-6	WHT	Input/Output Inner Conductor 50Ω Co-Ax
A4-13	--	Drain Wire	Shield (Chassis Ground)
A4-14	A9-3	YEL	Chopper Output
A4-15	A9-2	GRN	Chopper Input
A4-16	A9-8	BRN	Common Reference
A4-17	DS5	WHT-YEL-ORN	Overrange
A4-18	TB2-1,2	WHT-BLK	Common 1
A4-19	J5-12	WHT-YEL-RED	+3.6V
A4-20	A7-24	WHT-BRN	BCD 0.1
A4-21	A7-23	WHT-YEL-RED	BCD 0.2
A4-22	A7-22	WHT-YEL	BCD 0.4
A4-23	A7-21	WHT-GRA	BCD 0.8
A4-24	A7-20	WHT-BLU	BCD 1.0
A4-25	A2-19	WHT-YEL-GRN	
A4-26	A2-14	WHT-GRA	
A4-27	A2-12	WHT-BLU	
A4-28	A2-17	WHT-BRN	
A4-29	A2-18	WHT-YEL-RED	
A4-30	A2-11	WHT-GRN	
A4-31	A2-13	WHT-ORN	
A4-32	A2-15	WHT-BLU	
A4-33	S7	WHT-YEL-PRP	Cal Factor Polarity
A4-34	A10-5	WHT-YEL-BRN	Linear Cal Factor
A4-35	A2-10	WHT-YEL-ORN	
A4-36	J5-5	WHT	Output/Input

TABLE 6-4 (Cont)

A4-37	A10-6	WHT-GRA	Log Cal Factor
A4-38	A2-22	WHT-BRN	
A4-39	A2-4	WHT-BLU	
A4-40	TB3-1,2	WHT-PRP	-12.6V
A4-41	TB3-3,4	WHT-RED	+12.6V
A4-42	A6-31	BLK-ORN	Outer Conductor 50Ω Co-Ax
A4-43	A6-6	BLK-ORN	Inner Conductor 50Ω Co-Ax
A4-44	TB2-3,4	WHT-BLK	Common 1
A4-45	J 7	BLK	Inner Conductor 50Ω Co-Ax
A4-46	J 7	BLK	Outer Conductor 50Ω Co-Ax

A5 (Assembly 12103) RECTIFIER CIRCUIT

FROM	TO	COLOR	COMMENT
A5-1	T1-7	WHT-BLU	15 VAC (+12.6V Supply)
A5-2	DS7,DS5, A6-24	WHT-ORN	+12.6V Raw Supply
A5-3	T1-8	WHT-BLU	15 VAC (+12.6V Supply)
A5-4	TB2-3,4	WHT-BLK	Ground 1
A5-5	T1-5	WHT	15 VAC (-12.6V Supply)
A5-6	Q2-C	WHT-BLU	-12.6V Supply Pass Transistor
A5-7	T1-6	WHT	15 VAC (-12.6V Supply)
A5-8	TB3-1,2	WHT-PRP	-12.6V
A5-9	A4-1	WHT-YEL-GRN	+150V
A5-10	T1-13	WHT-YEL	150 VAC
A5-11	T1-14	WHT-YEL	150 VAC
A5-12	A7-8	WHT-YEL-RED	+180V
A5-13	A7-14	WHT-BLK	Common For +180V Supply
A5-14	T1-16	WHT-BLK	12 VAC Center Tap
A5-15	T1-15	WHT-ORN	12 VAC
A5-16	T1-17	WHT-ORN	12 VAC
A5-17	Q3-C	WHT-YEL-GRN	+3.6V Supply Pass Transistor
A5-18	TB2-1,2	WHT-BLK	Ground 2
A5-19	T1-11	WHT-BRN	7 VAC
A5-20	T1-12	WHT-BRN	7 VAC
A5-21	A8-1	WHT-GRN	Attenuator Coil (Calibrator)
A5-22	A8-2	WHT-BLU	Attenuator Coil (Calibrator)
A5-23	S6	WHT-BRN	-20 dBm (Calibrator)
A5-24	S6	WHT-ORN	-20 dBm (Calibrator)
A5-25	DS8	WHT-YEL-ORN	

A6 (Assembly 12072) TRIGGER CIRCUIT

FROM	TO	COLOR	COMMENT
A6-1	S4	WHT-YEL	
A6-2	S4	WHT-ORN	
A6-3	J-3	BLK	Outer Conductor 50Ω Co-Ax
A6-4	J-3	BLK	Inner Conductor 50Ω Co-Ax
A6-5	R9-Arm	WHT-YEL-GRN	
A6-6	A4-43	BLK-ORN	Inner Conductor 50Ω Co-Ax
A6-7	R9-CCW	WHT-YEL-BRN	
A6-8	R9-CW	WHT-BLU	
A6-9	A2-29	WHT-YEL-RED	
A6-10	J-2	BLK	Outer Conductor 50Ω Co-Ax
A6-11	J-2	BLK	Inner Conductor 50Ω Co-Ax

TABLE 6-4 (Cont)

A6-12	R6,R8	BRN	Outer Conductor 75Ω Co-Ax
A6-13	R7-Arm	BRN	Inner Conductor 75Ω Co-Ax
A6-14	RB3-1,2	WHT-PRP	-12.6V
A6-15	TB3-3,4	WHT-RED	+12.6V
A6-16	TB2-1,2	WHT-BLK	Common 2
A6-17	S9	WHT-ORN	
A6-18	S10	WHT-GRN	Trigger Reset Auto
A6-19	S4	WHT-BLU	
A6-20	S9	WHT-GRA	
A6-21			5 Sec Reset Disable (Connect to Common 2)
A6-22	R10-Arm	WHT-YEL-ORN	
A6-23	DS6	WHT	
A6-24	A5-2	WHT-ORN	+12.6V Raw Supply
A6-25	S5-N.D.	WHT-YEL	
A6-26	S5-N.C.	WHT-GRN	
A6-27	J-6	BLK-GRN	Inner Conductor 50Ω Co-Ax
A6-28	J-6	BLK-GRN	Outer Conductor 50Ω Co-Ax
A6-29	DS7	WHT-BLU	
A6-30	S4	WHT-BRN	
A6-31	A4-42	BLK-ORN	Outer Conductor 50Ω Co-Ax

A7 (Assembly 11354) DIGITAL DISPLAY

FROM	TO	COLOR	COMMENT
A7-1	TB-31,2	WHT-PRP	-12.6V
A7-2	Q3-B	WHT-BLU	+3.6V Supply Pass Transistor
A7-3	A5-17	WHT-YEL-GRN	+3.6V Raw Supply
A7-4	TB2-1,2	WHT-BLK	Common 2
A7-5	Q3-E	WHT-YEL-RED	+3.6V
A7-6	S4	WHT-YEL-PRP	
A7-7	TB3-3,4	WHT-RED	+12.6V
A7-8	A5-12	WHT-YEL-RED	+180V
A7-9	A2-24	WHT	Polarity On-Off
A7-10	J5-13	WHT-ORN	Polarity
A7-11	A2-16	WHT-GRN	Decimal 10^{-1}
A7-12	A2-20	WHT-YEL	Decimal 10^{-2}
A7-13	A2-21	WHT-YEL-PRP	Decimal 10^{-3}
A7-14	A5-13	WHT-BLK	Common For +180V Supply
A7-15	J5-3	WHT-YEL	Input/Output
A7-16			+4.0V
A7-17	A4-44	WHT-BLK	Common 1
A7-18	TB3-3,4	WHT-RED	+12.6V
A7-19	J5-15	WHT-GRN	Print Command
A7-20	A4-24	WHT-BLU	BCD 1.0
A7-21	A4-23	WHT-GRA	BCD 0.8
A7-22	A4-22	WHT-YEL	BCD 0.4
A7-23	A4-21	WHT-YEL-RED	BCD 0.2
A7-24	A4-20	WHT-BRN	BCD 0.1
A7-25			BCD 0.08
A7-26			BCD 0.04
A7-27			BCD 0.02
A7-28			BCD 0.01
A7-29			BCD 0.008
A7-30			BCD 0.004
A7-31			BCD 0.002
A7-32			BCD 0.001

TABLE 6-4 (Cont)

A8 (Assembly 12136) CALIBRATOR

FROM	TO	COLOR	COMMENT
A8-1	A5-21	WHT-GRN	Attenuator Coil (L6)
A8-2	A5-22	WHT-BLU	Attenuator Coil (L6)
A8-3	S6	WHT-YEL-RED	+12.6V Switched Calibrator
A8-4	TB2-3,4	WHT-BLK	Common 1
A8-5	TB3-1,2	WHT-PRP	-12.6V
A8-6	Chassis	WHT-BLK	Chassis Ground (C26)
A8J8	Front Panel	BLK	Output 50Ω Co-Ax

A9 (Assembly 12125) POWER DETECTOR AMPLIFIER

FROM	TO	COLOR	COMMENT
A9-1	A4-9	RED	+12.6V
A9-2	A4-15	GRN	Chopper Output
A9-3	A4-14	YEL	Chopper Input
A9-4	A4-10	BLU	-12.6V
A9-5	--		
A9-6	A4-12	WHT	Output/Input Inner Conductor 50Ω Co-Ax
A9-7	A4-11	WHT	Common 1 & Outer Conductor 50Ω Co-Ax
A9-8	A4-16	BRN	Common Reference

A10 (Assembly 12088) CAL FACTOR SWITCH

FROM	TO	COLOR	COMMENT
A10-1	S7	WHT-GRN	Polarity Log
A10-2	S7	WHT-YEL	Polarity (+) Linear
A10-3	S7	WHT-BLU	Off Linear
A10-4	S7	WHT-BRN	Polarity (-) Linear
A10-5	A4-34	WHT-YEL-BRN	Linear
A10-6	A4-37	WHT-GRA	Log
A10-7	S7	WHT-BLK	Common 1

CHASSIS

FROM	TO	COLOR	COMMENT
-	S4	BLK-GRN	50Ω Coax Outer Conductor to S4 ground
C2	S9	BLK-GRN	Assy 12211-1 50Ω Coax Inner Conductor
CR1,R11	TB3-1,2	WHT-PRP	-12.6V, Assy 12211-3
DS1	TB2-1,2	WHT-BLK	Common 2
DS6	DS1	WHT-BLK	Common 2
DS8	S7	WHT	Cal Factor On
F1	S1	RED	Shielded Pair
J1-1	F1	WHT-BLU	AC Input (Hot Side)
J1-2	Chassis	Shield	Chassis Ground
J1-3	S1	BLK	AC Input (Common Side) Shielded Pair
Q4,R12	TB2-1,2	WHT-BLK	Common 2, Assy 12211-5
R3	S7	WHT-RED	+12.6V
R3	S7	WHT-PRP	-12.6V
R10	S5	WHT-BLK	Common 1
R10	TB3-3,4	WHT-RED	+12.6V

TABLE 6-4 (Cont)

R10-CW	S4	WHT	Common 1
S1	T1-4	BLK	Shielded Pair
S1	T1-1	RED	Shielded Pair
S2	T1-2	WHT-ORN	
S2	T1-3	WHT-YEL	
S4	S9	WHT-BLU	
S4	S9	WHT-YEL-RED	
S4	S5	WHT-BLK	Common 2
S4	S9	BLK-GRN	50Ω Coax Center Conductor
S5	TB2-1,2	WHT-BLK	Common 2
S6	R3	WHT-RED	+12.6V
S7	TB2-3,4	WHT-BLK	Common 1
S7	R10	WHT-RED	+12.6V
S7	TB3-1,2	WHT-PRP	-12.6V
S4	S7	WHT-BLK	Common 1
T1-1	S2	WHT-BRN	
T1-4	S2	WHT-GRA	
S4	S9	BLK-GRN	50Ω Coax Outer Conductor(ground)
S10	A6-18	WHT-GRN	Trigger Reset Auto

6.8 ACTIVE DEVICE VOLTAGES, WAVEFORMS, TIMING DIAGRAMS AND FUNCTIONAL DIAGRAMS

The following tables and oscillograms are provided to assist in locating troubles and malfunctions within the instrument. Due to manufacturing tolerances and variations in adjustments, the measured values in a given instrument may vary slightly from those listed.

The following are the conditions under which the measurements were made (unless otherwise indicated):

Line voltage:	115 V ac
Ambient temperature:	27°C
Warm-up time:	>0.5 Hour

Control settings:

Power:	ON
Trigger reset rate:	MAX
Pulse averaging:	OFF
Trigger:	FREE RUN
Internal trigger level:	>-5 dBm and MIN
Cal factor:	0 and .05 dB
Calibrator:	+10 dBm
Trigger delay:	99.9 µs
Range:	+10 dBm DIRECT
-20 and +10 dBm Cal:	Adjusted after 0.5 hour warm-up period.

All voltage and waveform measurements were made using an oscilloscope with a 10:1 divider probe attached. The impedance of the probe is represented by 10 MΩ shunted by <10 pF. Direct (dc) coupling was used in every case; dc values are average, as estimated from the display. All measurements are with respect to signal common (black test jacks).

CHASSIS (Assembly 12085)

DEVICE	EMITTER	BASE	COLLECTOR	COMMENT
Q1	+12.6	+12	+18	See A1
Q2	0	+0.6	+6	See A1
Q3	+3.6	+4.2	+7	
Q4	-8	-7.2	0	

A1 ±12.6 VOLT POWER SUPPLY (Assembly 10121)

DEVICE	EMITTER	BASE	COLLECTOR	COMMENT
A1Q1	0	+0.6	+12	
A1Q2	-0.6	0	+0.6	
A1Q3	-0.6	0	+12.6	
Q1	+12.6	+12	+18	TP1
A1Q4	+0.6	+1.2	+11.5	
A1Q5	-7	-6.4	+1.2	
A1Q6	-7	-6.4	0	
Q2	0	+0.6	+6	TP3

A2 RANGE SWITCH AND LAMP DRIVER (Assembly 12047)

DEVICE	EMITTER	BASE	COLLECTOR	COMMENT
A2Q1	+6.3	+8	0	Same as A2Q2 when µW light is lit.
A2Q2	+6.3	+5.7	+6.3	
A2Q3	+6.3	+8	0	Same as A2Q2 when W light is lit.
A2Q4	+6.3	+8	0	Same as A2Q2 when KW light is lit.
A2Q5	+6.3	+5.7	+6.3	
A2Q7	Fig. 6-5	Fig. 6-4	Fig. 6-6	
A2Q8	-12.6	Fig. 6-6	Fig. 6-7	

Continued

A2 RANGE SWITCH AND LAMP DRIVER (Contd)

	Source Pin 1	Drain Pin 2	Gate Pin 3
A2Q6	+8	+8	Fig. 4
	Source 1 Pin 1	Drain 1 Pin 2	Gate 1 Pin 3
A2Q9	+9	+12.6	+8
	Source 2 Pin 5	Drain 2 Pin 6	Gate 2 Pin 7
A2Q9	+9	+12.6	+8

PIN	2	3	4	1/5	6	7	
A2U1	-	+8	-12.6	-	+8	+12.6	J1
A2U2	+9	+9	-12.6	-12.6	+8	+12.6	
A2U3	-	+8	-12.6	-	+8	+12.6	J3

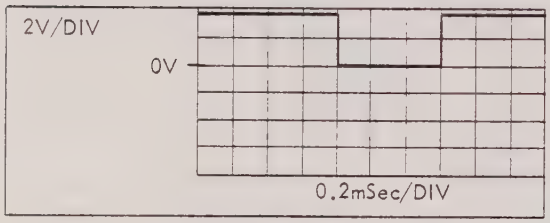


FIGURE 6-4

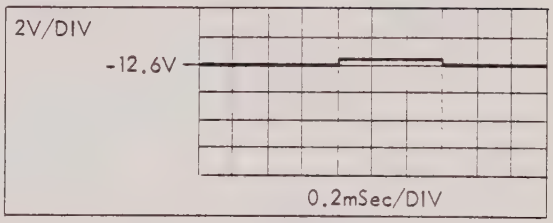


FIGURE 6-6

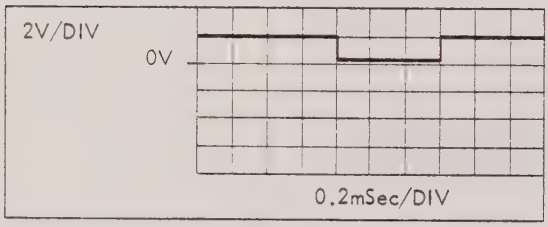


FIGURE 6-5

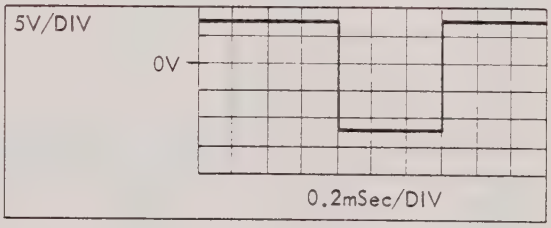


FIGURE 6-7

A3 PREAMP AND POLARITY SENSING (Assembly 11214)

DEVICE	EMITTER	BASE	COLLECTOR	COMMENT
A3Q2	0/+0.6	0	-12/-10	Polarity +/- Note 1
A3Q3	-12.6	-12	+1.4/-12.6	Polarity +/- Note 1

	2	3	4	6	7	1/8	
A3QA1	0	0	-12.6	-1	+12.6	+8/+9	TP31
A3QA2	-0.6	-0.6	-12.6	-0.5	+12.6	+8/+9	TP32
A3QA3	+0.4	+0.4	-12.6	+1	+12.6	+8/+9	

Note 1: The polarity can be displayed as minus by switching the calibrator output to -20 dBm.

A4 INPUT CIRCUIT (Assembly 12042)

DEVICE	EMITTER	BASE	COLLECTOR	COMMENT
A4Q2	-0.6	0	0	Note 1 J4 and J1
A4Q3	-0.6	0	0	Note 1 J4 and J1
A4Q4	-12.5	-12	+12.6	J5
A4Q5	+0.6	0	-8	
A4Q6	0	0/+0.6	+18/0	Overrange OFF/ON
A4Q8	+4	+4.6	+12.6	
A4Q11	-6.3	-5.7	Fig. 6-8	
A4Q12	+9	+8.4	Fig. 6-8	
A4Q13	+9	+8.4	0	
A4Q14	Fig. 6-9	Fig. 6-8	+12.6	
A4Q15	+6	+6	-12.6	J10 Fig. 6-10
A4Q17	-12.6	-12	-12	J11 Fig. 6-11
A4Q20	-6.3	-5.7	+6	
A4Q21	+9	+8.4	-3	
A4Q22	+9	+8.4	-1	
A4Q23	-0.6	0	+46	
A4Q24	+45	+46	+150	J8
A4Q26	Fig. 6-12	Fig. 6-12	-9	
A4Q27	-9.6	-9	Fig. 6-12	
A4Q28	-9.6	-9	Fig. 6-12	
	Source Pin 1	Drain Pin 2	Gate Pin 3	
A4Q31	-3.5	-12.6	0	
A4Q32	0	Fig. 6-13	Fig. 6-12	J9

	Drain Pin 1	Source Pin 2	Gate Pin 3	Pin 4	
A4Q9	-	+4	-12.6	0	J6 and J10 Fig. 6-10
A4Q18	+4	Fig. 6-9	-12	Fig. 6-9	J7 and J11
A4Q29	0	0	Fig. 6-12	0	
A4Q30	0	0	Fig. 6-12	0	

	Source 1 Pin 1	Drain 1 Pin 2	Gate 1 Pin 3	
A4Q1	+1.2	+12.6	0	J1
A4Q10	Fig. 6-8	+8.4	-	
A4Q19	+6	+8.4	+4	

	Source 2 Pin 5	Drain 2 Pin 6	Gate 2 Pin 7	
A4Q1	+1.2	+12.6	0	
A4Q10	Fig. 6-8	+8.4	Fig. 6-8	
A4Q19	+6	+8.4	+4	

PIN	2	3	4	5	6	7	
A4U1	+1.2	+1.2	-12.6	-12.6	-6	+12.6	J1 and J2
A4U2	0	0	-12.6	-	+0.5	+12.6	J2
A4U3	-0.5	-0.5	-12.6	-	-10	+12.6	Overrange light off
A4U7	-0.6	-0.6	-12.6	-12.6	0	+12.6	

Note 1: Measure emitter at J4 and collector at J1.

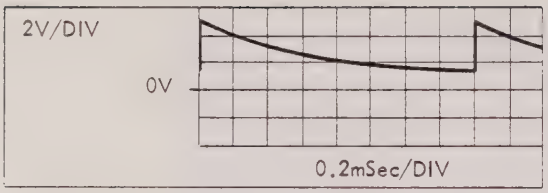


FIGURE 6-8

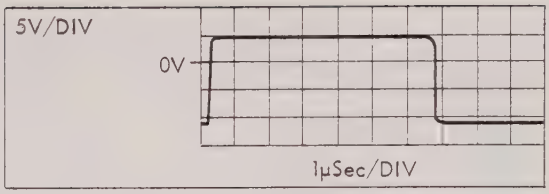


FIGURE 6-11

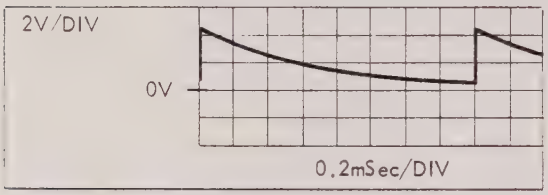


FIGURE 6-9

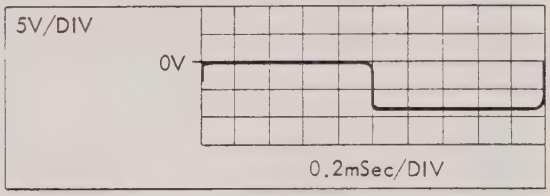


FIGURE 6-12

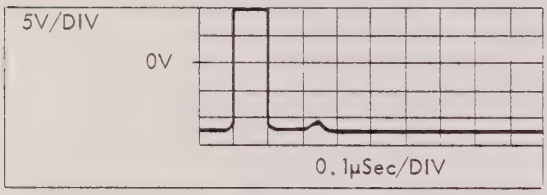


FIGURE 6-10

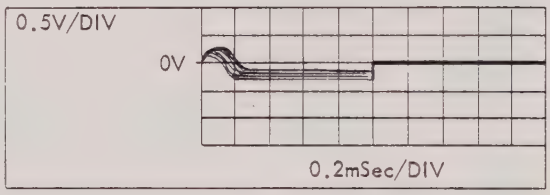


FIGURE 6-13

A5 RAW SUPPLIES (Assembly 12103)

DEVICE	EMITTER	BASE	COLLECTOR	COMMENT
A5Q1	+150	+150	+200	
A5Q2	0	0/+0.6	+8/0	Calibrator Output +10 dBm/-20 dBm

A6 TRIGGER CIRCUIT (Assembly 12072)

DEVICE	EMITTER	BASE	COLLECTOR	COMMENT
A6Q1	0	+0.6/0	0/+18	Reset Light ON/OFF
A6Q2	0	0	0→+1.6	No Trigger (Trigger Internal)
A6Q3	0→+1	0→+1.6	+5	No Trigger (Trigger Internal)
A6Q4	0	0→+0.6	+1.5→+5	No Trigger (Trigger Internal)
A6Q5	0	0	+5	
A6Q6	+5	0	+0.6	
A6Q7	+5.6	+5	0	
A6Q8	+5	+5.6	+15	J1
A6Q9	-6.3	-6.9	-12.6	
A6Q10	0	0→+0.6	0→+5.6	With Trigger Reset Rate Set to 9 o'clock
A6Q11	+6.2	+5.6	0	
A6Q12	0	0/+0.6	+16/0	New Data Light OFF/ON
A6Q13	+15.5	+15	0/+16	New Data Light OFF/ON
A6Q14	+16	+15.5	0/+16	New Data Light OFF/ON
A6Q15	Fig. 6-14	Fig. 6-15	-12.6	
A6Q16	0	Fig. 6-16	Fig. 6-17	
A6Q17	Fig. 6-18	Fig. 6-19	Fig. 6-17	
A6Q18	Fig. 6-20	Fig. 6-21	Fig. 6-17	

Continued

A6 TRIGGER CIRCUIT (Contd)

A6Q19		Fig. 6-18		Fig. 6-17		Fig. 6-21	
A6Q20		Fig. 6-22		+5		+12.6	Note 1
A6Q21		Fig. 6-20		Fig. 6-22		+12.6	
	PIN	2	3	4	6	7	8
A6U2		0	0	-6.3	-		+12.6
A6U7		+5.6	0 +5.6	-12.6	-11	+12.6	-
	PIN	2	3	4	6	12	13
A6U1		0	0	0	-12.6	-	+12.6

With Trigger Reset Rate Set to 9 o'clock.

Pulse Amp. With AC Gain Of 32 and Non-inverting.

Note 1: The voltage on the base depends on where the Trigger Delay is set. At 0 delay the voltage is slightly positive and 100 μ Sec delay is +5 volts.

Note 2: See Figure 6-23 for A6 Functional Diagram and Figure 6-24 for A6 Timing Diagram.

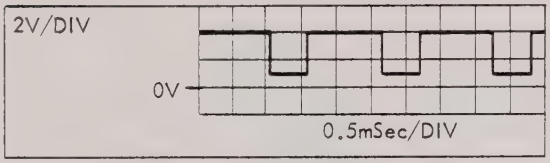


FIGURE 6-14

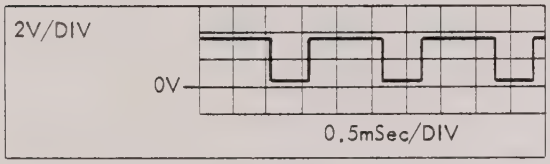


FIGURE 6-15

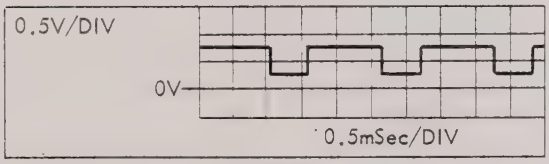


FIGURE 6-16

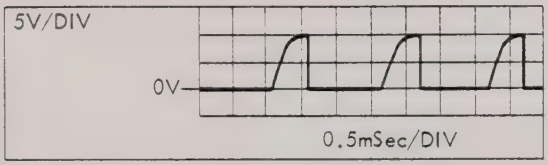


FIGURE 6-17

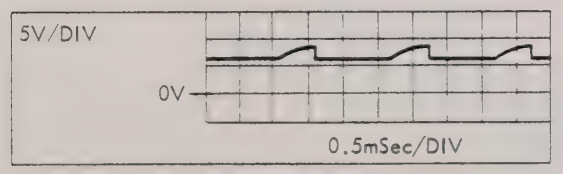


FIGURE 6-18

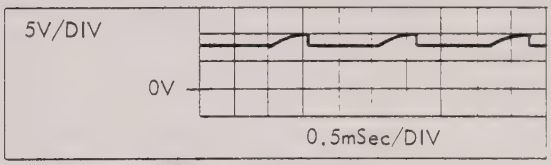


FIGURE 6-19

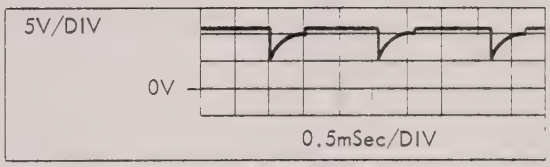


FIGURE 6-20

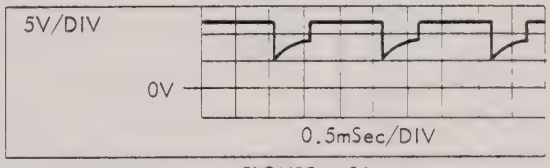


FIGURE 6-21

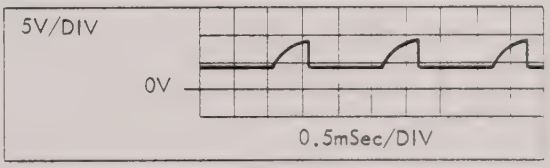
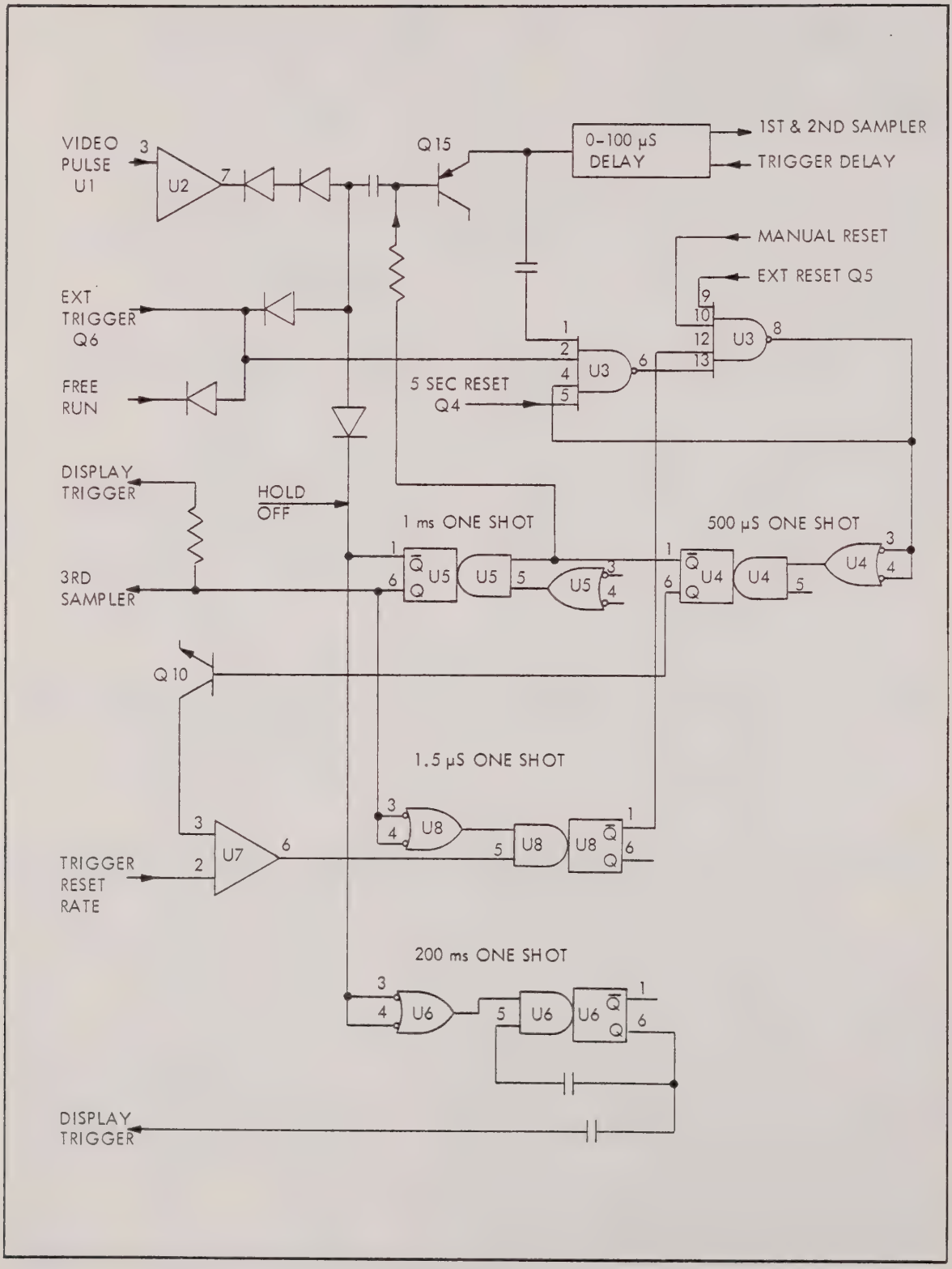
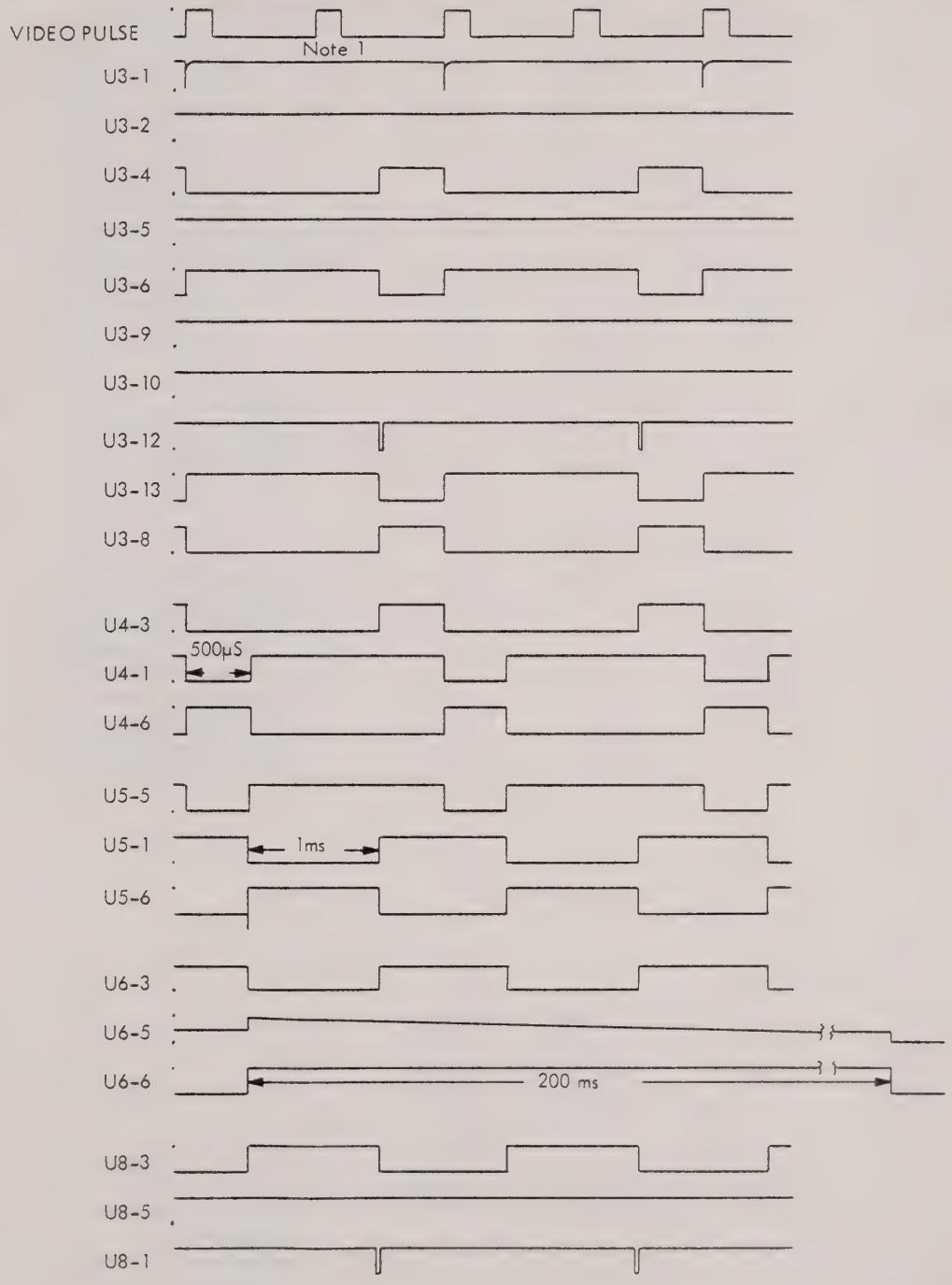


FIGURE 6-22



A6 TRIGGER CIRCUIT
FUNCTIONAL DIAGRAM

FIGURE 6-23



NOTE 1. Does not generate a trigger because of hold off from U5-1.

A6 TRIGGER CIRCUIT
TIMING DIAGRAM

FIGURE 6-24

A7 DIGITAL DISPLAY (Assembly 11354)

DEVICE	EMITTER	BASE	COLLECTOR		COMMENT	
A7Q1	+12.6	+12.6/+12	-/+12.6	1.0	Not Needed/Needed	
A7Q2	-/+4	+4/+3.4	+4.0	1.0	Not Needed/Needed	Note 1
A7Q3	0	0/+0.6	+12.6/0	1.0	Not Needed/Needed	
A7Q4	+12.6	+12.6/+12	-/+12.6	0.8	Not Needed/Needed	
A7Q5	-/+4	+4/+3.4	+4.0	0.8	Not Needed/Needed	Note 1
A7Q6	0	0/+0.6	+12.6/0	0.8	Not Needed/Needed	
A7Q7	+12.6	+12.6/+12	-/+12.6	0.4	Not Needed/Needed	
A7Q8	-/+4	+4/+3.4	+4.0	0.4	Not Needed/Needed	Note 1
A7Q9	0	0/+0.6	+12.6/0	0.4	Not Needed/Needed	
A7Q10	+12.6	+12.6/+12	-/+12.6	0.2	Not Needed/Needed	
A7Q11	-/+4	+4/+3.4	+4.0	0.2	Not Needed/Needed	Note 1
A7Q12	0	0/+0.6	+12.6/0	0.2	Not Needed/Needed	
A7Q13	-/+4	+4/+3.4	+4.0	0.1	Not Needed/Needed	Note 1
A7Q14	0	0/+0.6	+12.6/0	0.1	Not Needed/Needed	
A7Q15	-/+4	+4/+3.4	+4.0	0.08	Not Needed/Needed	Note 1
A7Q16	0	0/+0.6	+12.6/0	0.08	Not Needed/Needed	
A7Q17	-/+4	+4/+3.4	+4.0	0.04	Not Needed/Needed	Note 1
A7Q18	0	0/+0.6	+12.6/0	0.04	Not Needed/Needed	
A7Q19	-/+4	+4/+3.4	+4.0	0.02	Not Needed/Needed	Note 1
A7Q20	0	0/+0.6	+12.6/0	0.02	Not Needed/Needed	
A7Q21	+4.0	+4/+3.4	-/+4	0.01	Not Needed/Needed	
A7Q22	0	0/+0.6	+12.6/0	0.01	Not Needed/Needed	
A7Q23	+4.0	+4/+3/4	-/+4	0.008	Not Needed/Needed	
A7Q24	0	0/+0.6	+12.6/0	0.008	Not Needed/Needed	
A7Q25	+4.0	+4/+3.4	-/+4	0.004	Not Needed/Needed	
A7Q26	0	0/+0.6	+12.6/0	0.004	Not Needed/Needed	
A7Q27	+4.0	+4/+3.4	-/+4	0.002	Not Needed/Needed	
A7Q28	0	0/+0.6	+12.6/0	0.002	Not Needed/Needed	
A7Q29	+4.0	+4/3.4	-/+4	0.001	Not Needed/Needed	
A7Q30	0	0/+0.6	+12.6/0	0.001	Not Needed/Needed	
A7Q31	+4.6 q	+5.2	+7			
A7Q32	-0.6	0	+5.2			
A7Q33	Pin 3	Pin 2	Pin 1			
	+3.4	+4	+8			
A7Q33	Pin 5	Pin 6	Pin 7			
	+3.4	+4	+8			
A7Q34	+8.6	+8	0			
A7Q35	+8.6	+0	+4.6			
A7Q36	+4	+4.6	+12.6			
A7Q37	0	Fig. 6-26	Fig. 6-25			
A7Q38	Fig. 6-26	Fig. 6-27	Fig. 6-28			
A7Q39	Fig. 6-29	Fig. 6-30	Fig. 6-31			
A7Q40	0	Fig. 6-29	Fig. 6-32			
A7Q41	Fig. 6-32	Fig. 6-32	+3.6			
A7Q44	-	-	+3.6			
A7Q45	0	+0.6/0	0/+70		Polarity + ON/OFF	
A7Q46	0	+0.6/0	0/+70		Polarity - ON/OFF	
A7Q47	0	+0.6/0	0/+70		Overrange 1 ON/OFF	
QA1 thru QA4					See Figure 6-33	
QA5 thru QA8					See Figure 6-34	
QA9 thru QA13					See Figure 6-34 and Table 6-5	
QA14 thru QA20					See Figure 6-36	
QA21 thru QA23					BCD to Decimal Decoder Driver	
QA24					See Figure 6-35	

	Pin						
	4	5	6	10	11	12	
QA25	-/+	0	-12.6	+/1	+12.6	-	BCD No. Not Needed/BCD No. Needed

Note 1: This transistor is used in a reverse configuration. The collector is used as the emitter and the emitter as the collector.

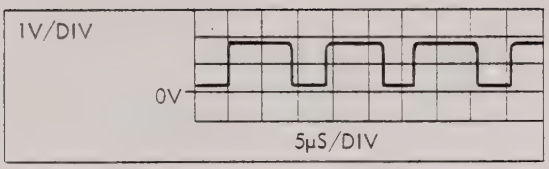


FIGURE 6-25

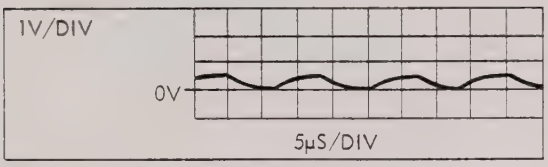


FIGURE 6-26

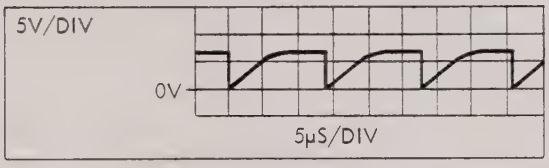


FIGURE 6-27

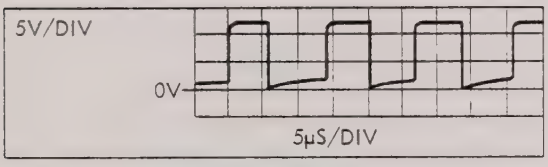


FIGURE 6-28

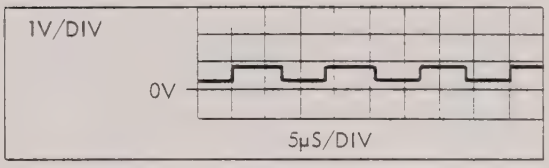


FIGURE 6-29

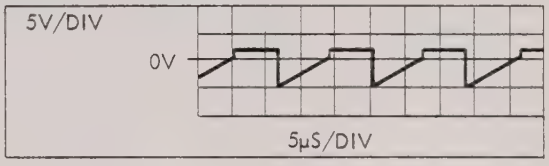


FIGURE 6-30

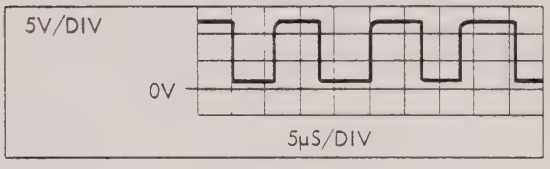


FIGURE 6-31

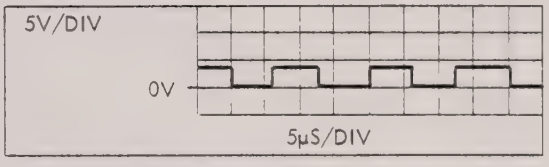


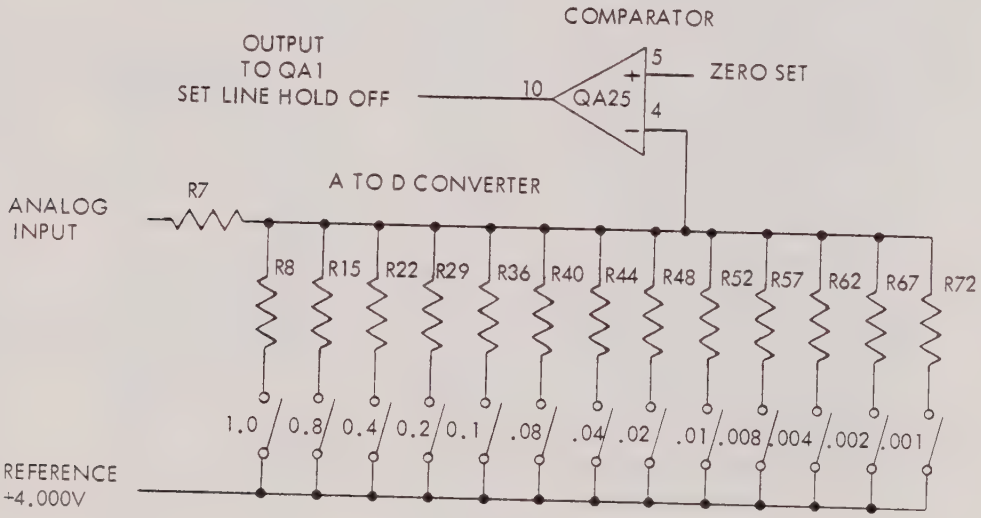
FIGURE 6-32

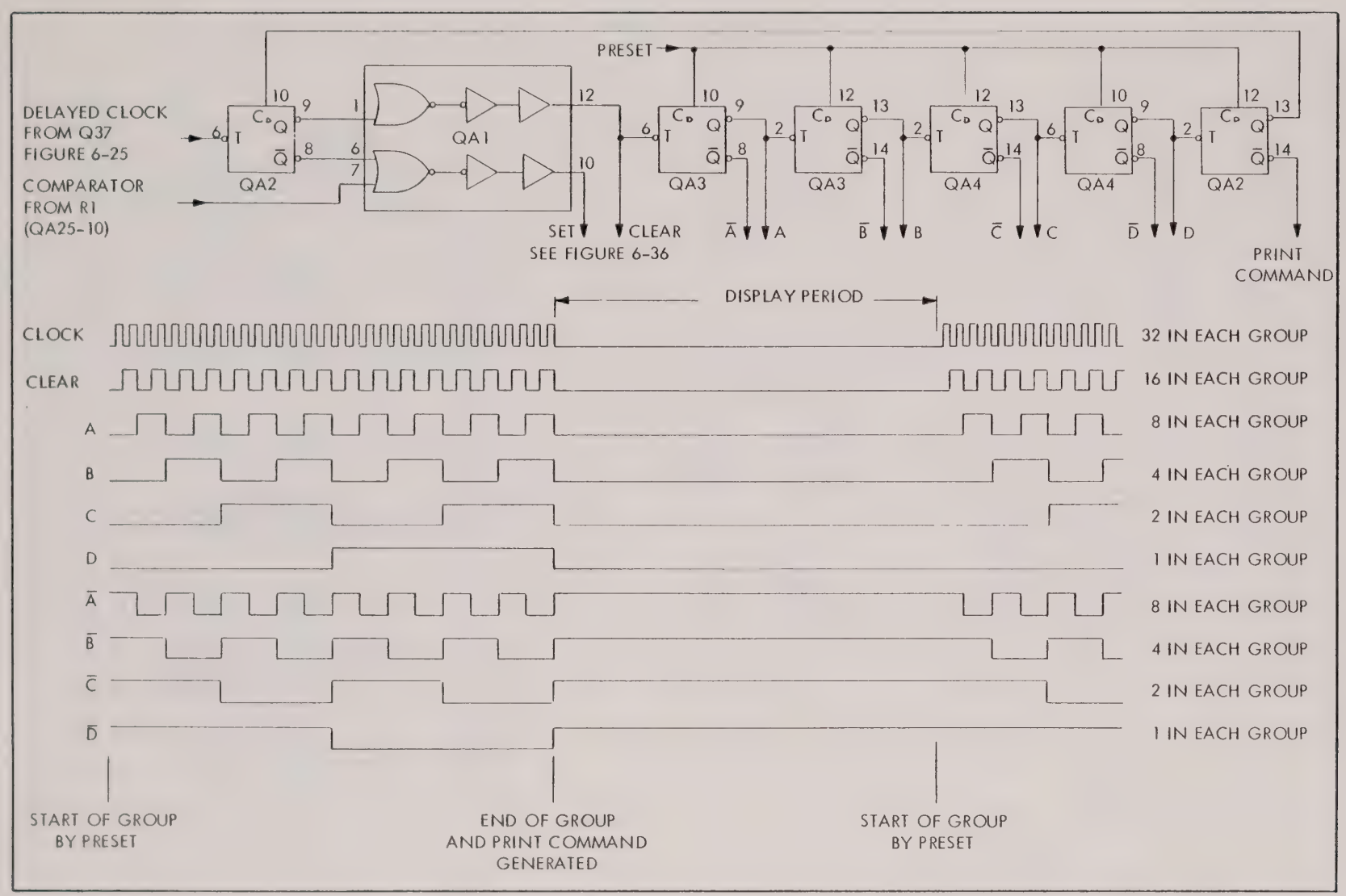
COMPARATOR CIRCUIT

When the current from the analog input equals the current from the reference 4.0 volts the input to the comparator is zero volts and the proper BCD switches are closed.

The BCD switches are closed by the BCD drive lines from the memory output in sequence from the BCD 1.0 to the BCD 0.001. As each switch is closed the voltage to the comparator will be positive if the BCD number is not needed and positive if it is needed. When the input to the comparator is negative the output from the comparator is positive which keeps the Set line up for that BCD number. Then the output from the Memory remains up for the measurement and display period and keeps that BCD switch in the A to D converter closed.

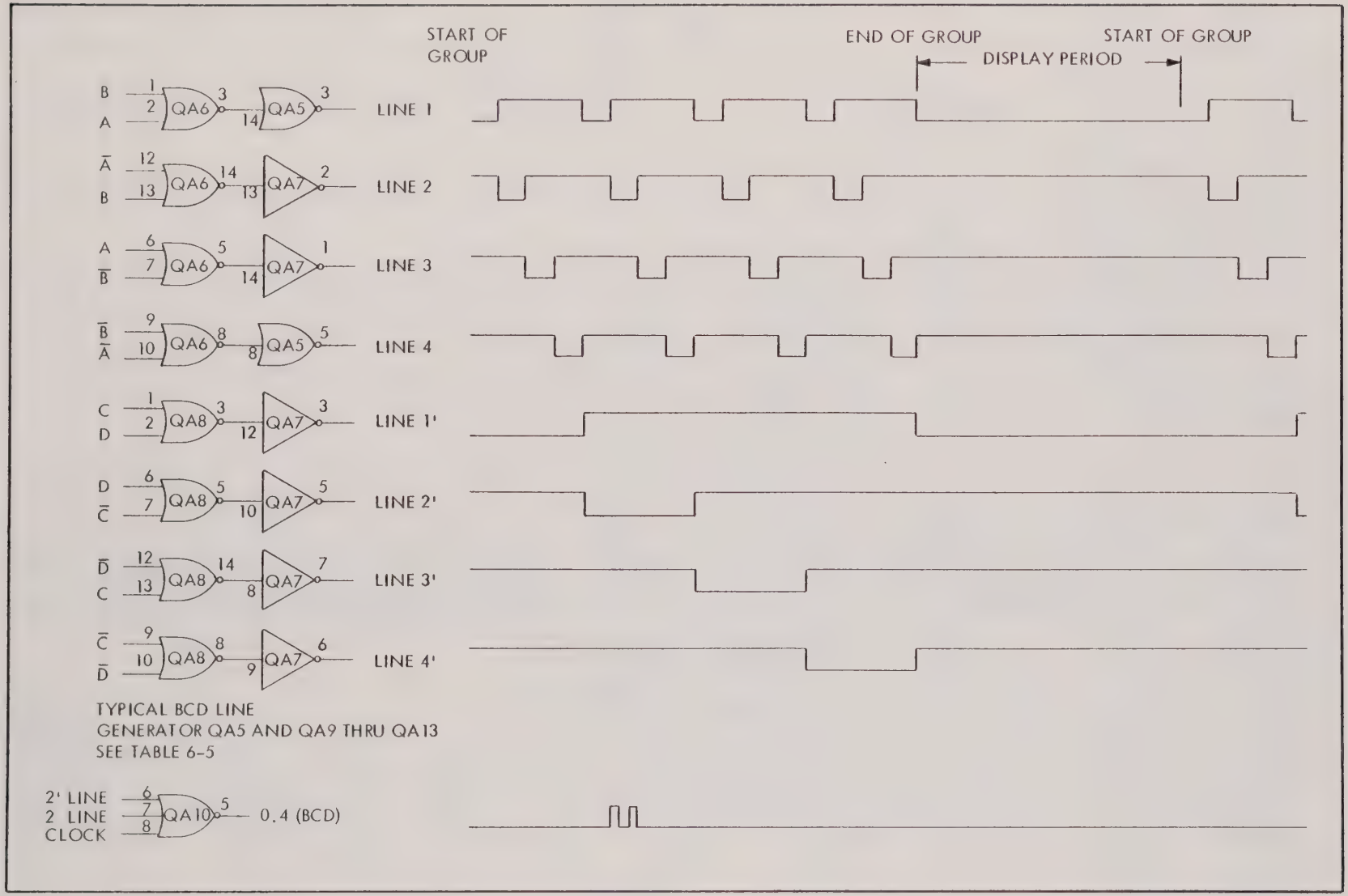
An analog input of -4.000 volts will result in a display of 1.000. As an example of how a reading is determined let us start with an analog input of -2.772 V which will result in a reading of .693.





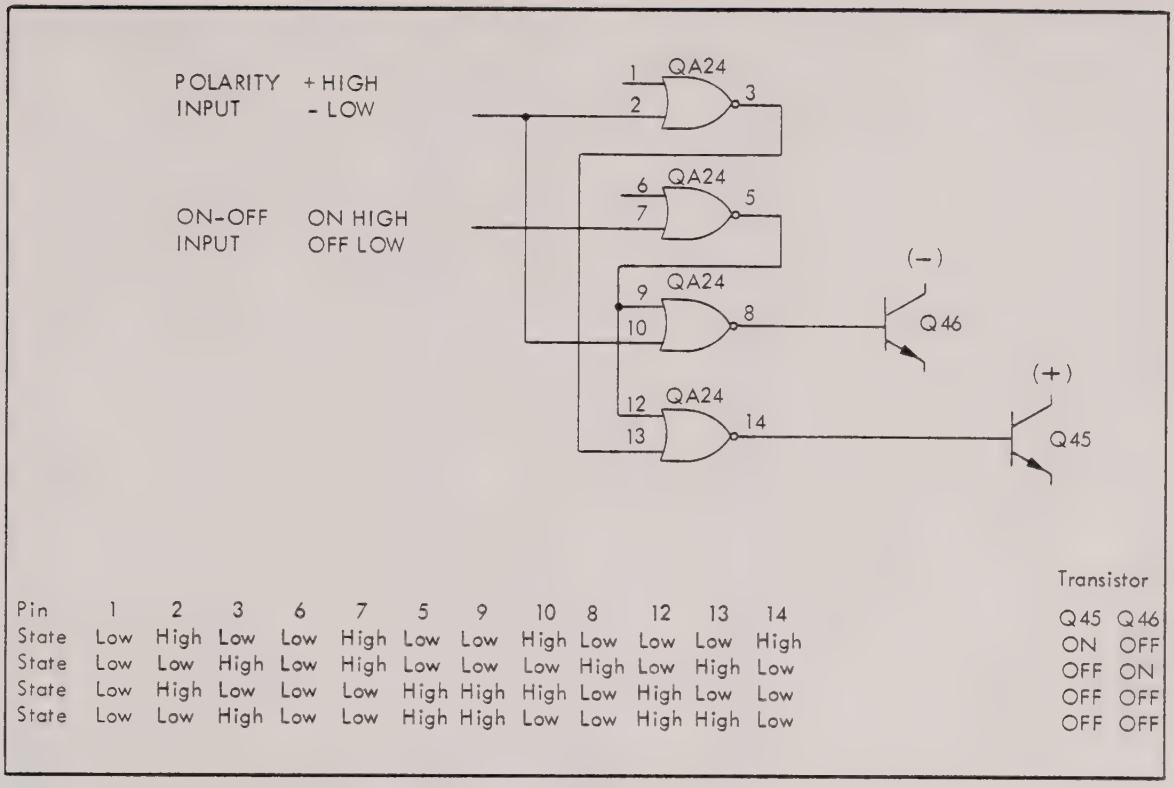
TIMING DIAGRAM

FIGURE 6-33



TIMING DIAGRAM

FIGURE 6-34



Pin	1	2	3	6	7	5	9	10	8	12	13	14	Transistor Q45	Transistor Q46
State	Low	High	Low	Low	High	Low	Low	High	Low	Low	Low	High	ON	OFF
State	Low	Low	High	Low	High	Low	Low	Low	High	Low	High	Low	OFF	ON
State	Low	High	Low	Low	Low	High	High	High	Low	High	Low	Low	OFF	OFF
State	Low	Low	High	Low	Low	High	High	Low	Low	High	High	Low	OFF	OFF

POLARITY

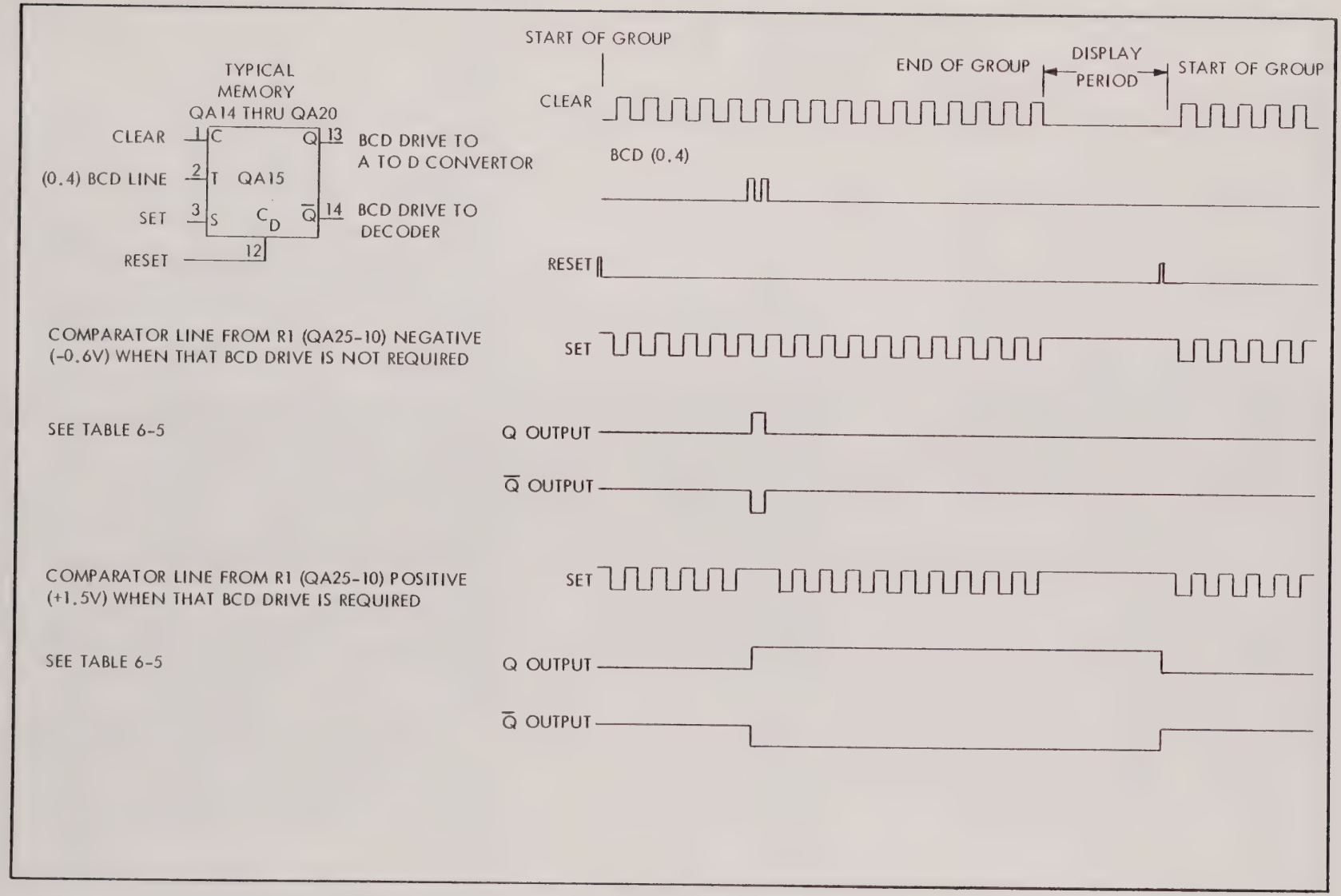
FIGURE 6-35

TABLE 6-5

BCD LINE GENERATORS

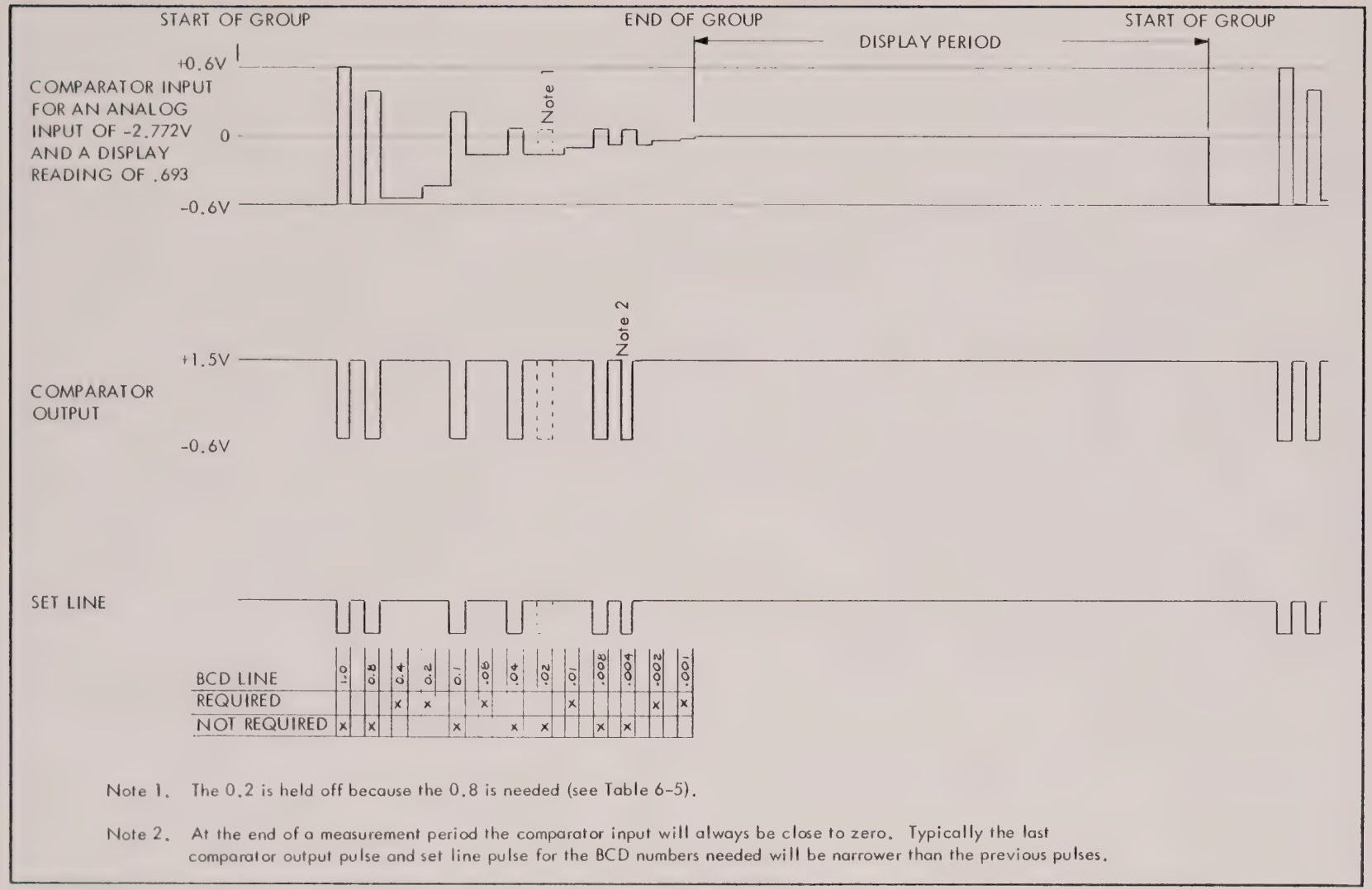
BCD LINE	INPUT PIN		INPUT PIN	INPUT LINE	INPUT PIN	INPUT LINE	OUTPUT PIN	OUTPUT CLOCK PULSES	DEVICE	INPUT PIN	INPUT BCD	COMMENT
1.0	12	Clock	10	4	13	1'	9	7 & 8	QA5			
0.8	14	Clock	1	1	2	2'	3	9 & 10	QA10			
0.4	8	Clock	7	2	6	2'	5	11 & 12	QA10			
0.2	13	Clock	2	3	14	2'	12	13 & 14	QA9	3	0.8	Note 1
0.1	14	Clock	1	4	2	2'	3	15 & 16	QA11			
0.08	13	Clock	12	1	10	3'	9	17 & 18	QA10			
0.04	8	Clock	6	2	7	3'	5	19 & 20	QA11			
0.02	2	Clock	3	3	14	3'	12	21 & 22	QA13	3	0.08	Note 1
0.01	14	Clock	1	4	2	3'	3	23 & 24	QA12			
0.008	13	Clock	12	1	10	4'	9	25 & 26	QA11			
0.004	8	Clock	6	2	7	4'	5	27 & 28	QA12			
0.002	5	Clock	6	3	7	4'	10	29 & 30	QA13	9	0.008	Note 1
0.001	13	Clock	12	4	10	4'	9	31 & 32	QA12			

NOTE 1. The input with the BCD 0.8 compliment for the BCD 0.2 output is used as a hold off so the BCD 1.0 is generated only one way. This is the same for the BCD 0.1 and 0.001.



TIMING DIAGRAM

FIGURE 6-36



Note 1. The 0.2 is held off because the 0.8 is needed (see Table 6-5).

Note 2. At the end of a measurement period the comparator input will always be close to zero. Typically the last comparator output pulse and set line pulse for the BCD numbers needed will be narrower than the previous pulses.

COMPARATOR CIRCUIT
TIMING AND WAVEFORM DIAGRAMS

FIGURE 6-37

A8 CALIBRATOR (Assembly 12136)

DEVICE	EMITTER	BASE	COLLECTOR				COMMENT
A8Q1	-	0	-				
A8Q2	0	+0.6	-			J2	
PIN	2	3	4	5	6	7	
A8U1	0	0	-12.6	-	+5.5	+12.6	J5
A8Q3	+12.2		+12.4		0		J2

A9 DETECTOR AMPLIFIER (Assembly 12125)

DEVICE	EMITTER	BASE	COLLECTOR		COMMENT
A9Q3	+10	+9.4	-6		
A9Q4	+10	+9.4	-6		
A9Q5	-6.6	-6	+12.6		
A9Q6	-6.6	-6	-0.6		
A9Q7	-0.6	0	+5.2		
A9Q8	+4.6	+5.2	+12.6		
A9Q9	+4	+4.6	+12.6		
	Drain	Source	Gate		
	Pin 1	Pin 2	Pin 3		
A9Q1	+9.4	+1.4	0	TP91	
A9Q2	+9.4	+1.4	0		

SECTION 7
PARTS LIST AND SCHEMATIC DIAGRAMS

This section contains the illustrated parts lists and the schematic diagrams of the assemblies which make up the Model 1018A. The assemblies are identified by a reference designation with the letter A followed by a number (e.g., A1, A2, etc.).

Each assembly is provided with its parts list, component locating illustration and schematic diagram. All electrical components are identified in the parts list and are indexed to the illustration by a location code referenced to a grid system.

The Replaceable Parts List cross-referencing the Pacific Measurements part numbers to the original manufacturers' part numbers and the abbreviated list of Federal Supply Codes are included at the rear of this section.

CONTENTS

		Page No.	Assembly	Schematic Diagram
-	LOG/LIN R.F. PEAK POWER METER	7-2	12085	12087
-	FRONT PANEL	7-5	12090	12087
A1	± 12.6V POWER SUPPLY	7-7	10121	10420
A2	RANGE SWITCH	7-9	12047	12048
A3	PREAMP AND POLARITY SENSING	7-12	11214	11215
A4	INPUT CIRCUIT	7-15	12042	12043
A5	RECTIFIER CIRCUIT	7-22	12103	12087
A6	TRIGGER CIRCUIT	7-24	12072	12073
A7	DIGITAL DISPLAY	7-29	11354	11446
A8	CALIBRATOR OSCILLATOR AND ATTENUATOR	7-35	12136	12109
A9	POWER DETECTOR AMPLIFIER	7-40	12125	11497
A10	CALIBRATOR FACTOR SWITCH	7-43	12088	12089
-	PART NUMBER/CROSS REFERENCE	7-46		
-	FEDERAL SUPPLY CODE FOR MANUFACTURERS	7-49		

REPLACEABLE PARTS LIST

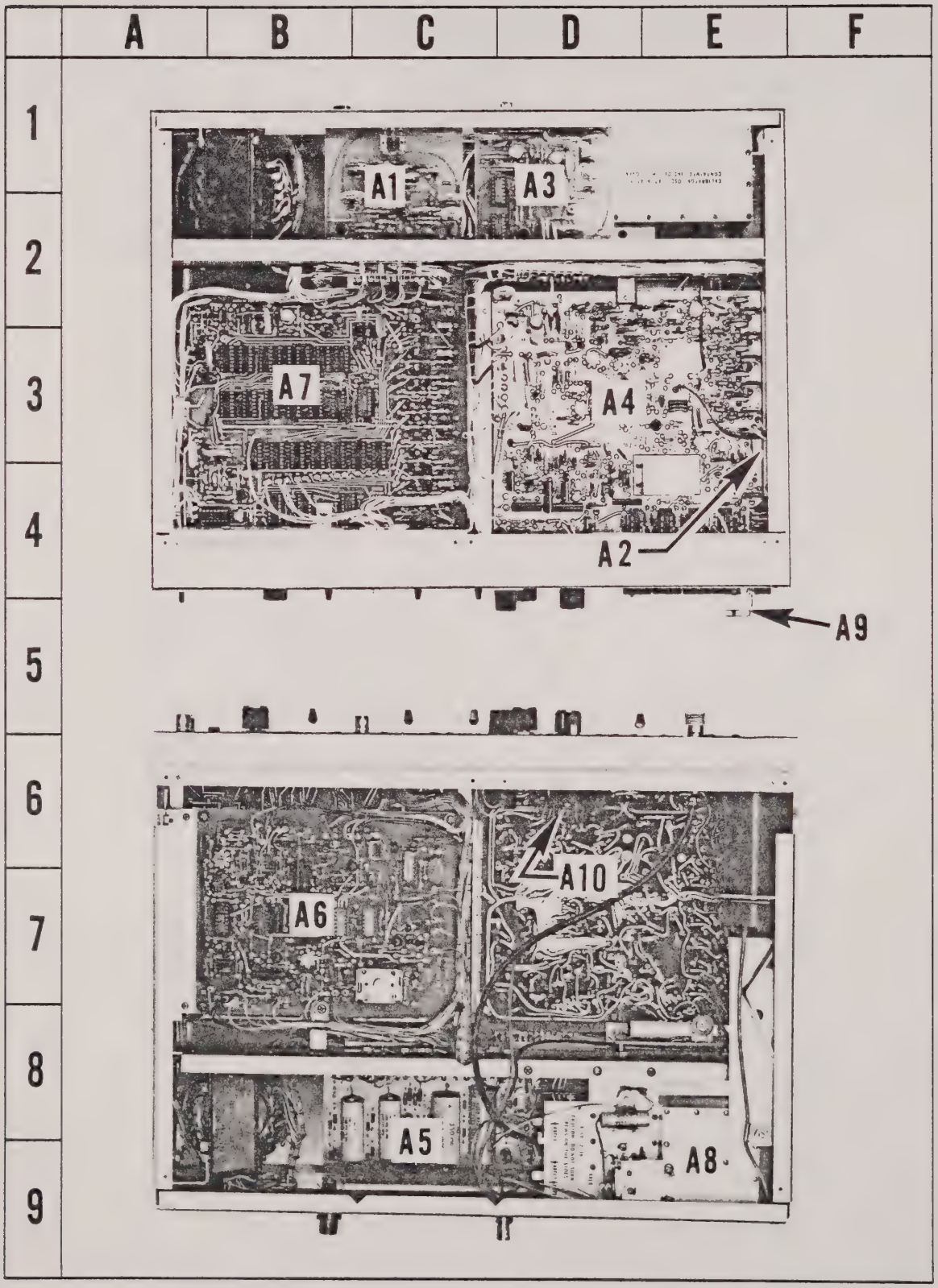
LOG/LIN RF PEAK POWER METER - 12085
(Refer to Fig. 7-1)

REF. DESIG.	LOCATION	DESCRIPTION	PART NO.	TOT. QTY.
-	C-6	Front Panel Assy	12090	1
A1	C-1	Power Supply PC Board Assy	10121	1
A2	E-4	Range Switch PC Board Assy	12047	1
A3	D-1	Preamp & Polarity PC Board Assy	11214	1
A4	E-3	Input Circuit PC Board Assy	12042	1
A5	C-8	Rectifier PC Board Assy	12103	1
A6	B-7	Trigger Circuit PC Board Assy	12072	1
A7	B-3	Digital Display PC Board Assy	11354	1
A8	E-9	Calibrator Oscillator Assy	12136	1
A9	*	Power Detector Amplifier Assy	12125	1
A10	D-6	Cal Factor Switch Assy	12088	1
C2	E-8	Cap, mylar, 5.0 µF 10% 200 V	10011-1	1
CR1	E-8	Diode 1N4148	10043	
DS1	C-4	Lamp, 6.0 V 66 ma	11387-2	5
DS2	C-4	Lamp, 6.0 V 66 ma	11387-2	Ref
DS3	C-4	Lamp, 6.0 V 66 ma	11387-2	Ref
DS4	C-4	Lamp, 6.0 V 66 ma	11387-2	Ref
DS9	C-4	Lamp, 6.0 V 66 ma	11387-2	Ref
F1	B-9	Fuse, 3 AG 0.5 A 250 V	10064-2	1
J1	B-9	AC Receptacle, 3 pin	12355	1
J4	C-2	Connector, 15 contacts	10050-1	2
J5	D-2	Connector, 15 contacts	10050-1	Ref
J7	D-9	Jack, Type BNC	11504	1
Q1	C-8	Transistor, RCA 40250	10020	3
Q2	C-8	Transistor, RCA 40250	10020	Ref
Q3	C-8	Transistor, RCA 40250	10020	Ref
Q4	E-8	Transistor, 2N3565	10019	1
R11	E-8	Res, car flm, 3.3 KΩ 5% 1/4 W	10013-31	1
R12	E-8	Res, met flm, 3.48 KΩ 1% 1/4 W	10015-176	1
R13	E-8	Res, var comp, 500 Ω 20% 1/4 W	10046-1	1
R14	E-8	Res, met flm, 2.00 KΩ 1% 1/4 W	10015-74	1
S2	B-9	Switch, Slide	11160	1
T1	B-8	Transformer, Power	10791	1
XF1	B-9	Fuseholder	11856	1
	E-6	Crystal Detector Holder	12127	1

REPLACEABLE PARTS LIST

REF. DESIG.	LOCATION	DESCRIPTION	GM PART NO.	TOT. QTY.
	*	Power Cord	12356	1
	*	Lamp Base	11385	5
	*	Lamp Cap, White	11386-1	5
	*	Top Cover	10325	1
	*	Bottom Cover	12217	1
	*	Bail	10811	1

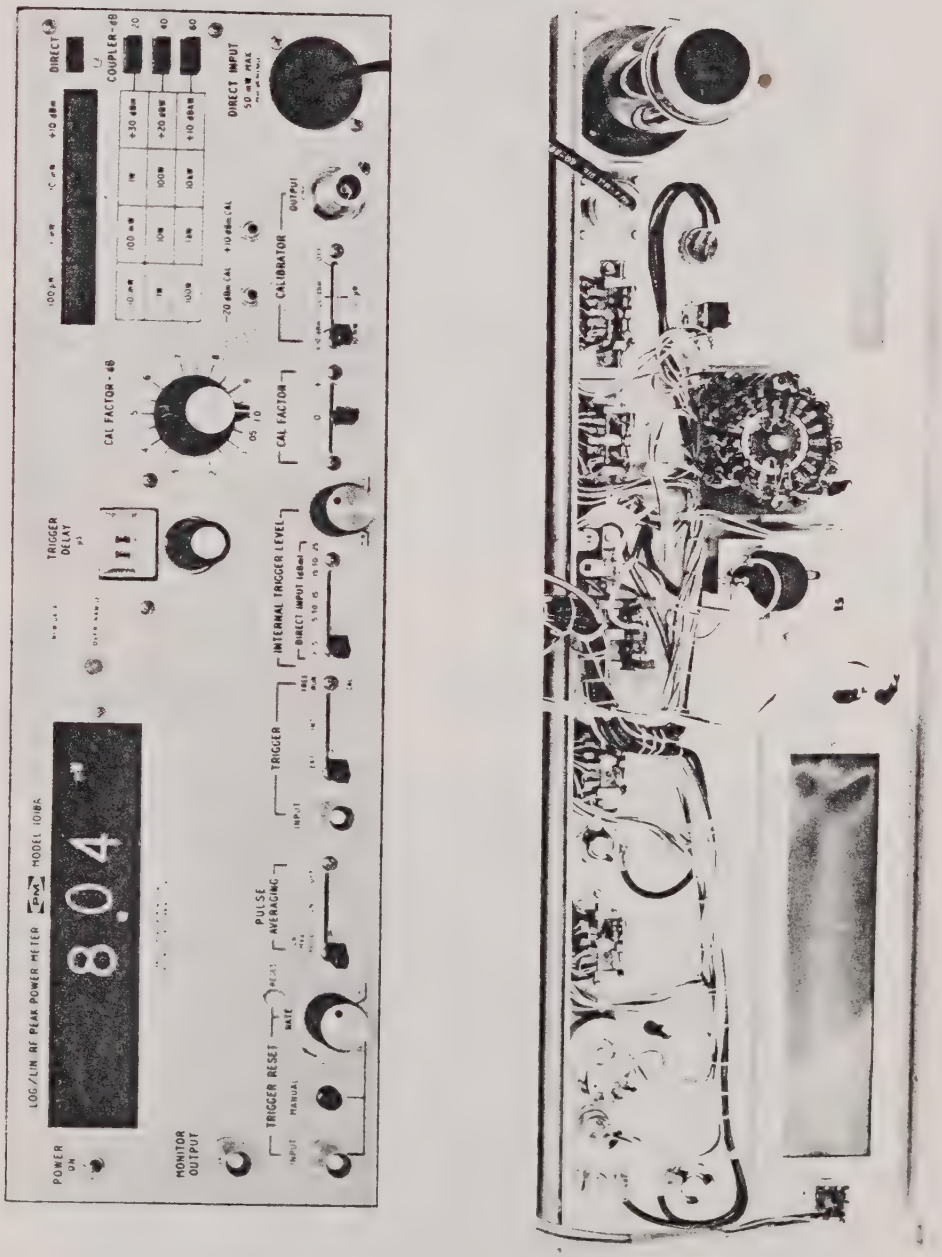
*Not Illustrated.



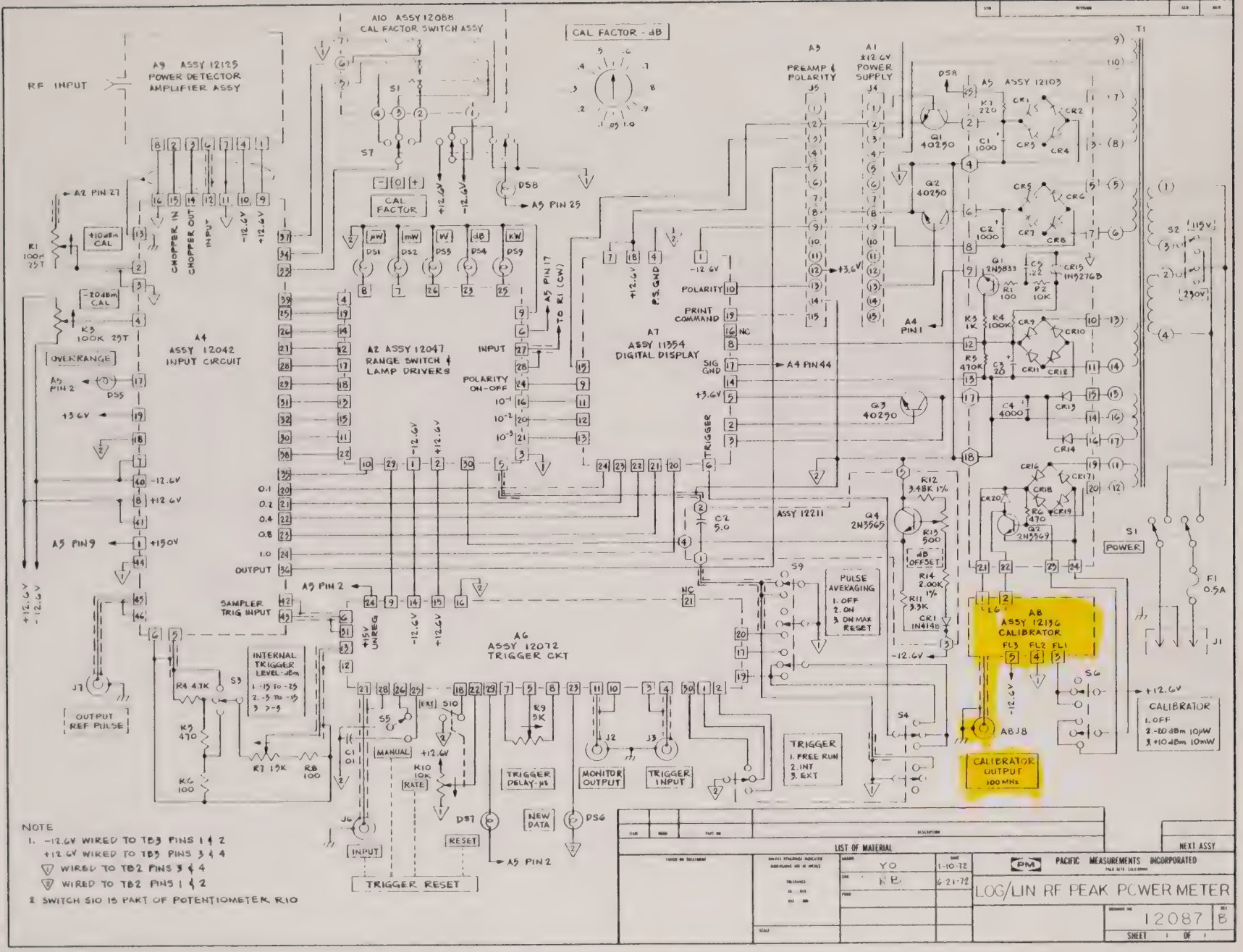
LOG/LIN RF PEAK POWER METER
FIGURE 7-1

REPLACEABLE PARTS LIST

REF. DESIG.	LOCATION	DESCRIPTION	HP PART NO.	TOT. QTY.
		FRONT PANEL ASSY - 12090 (Refer to Fig. 7-2)		
C1	D-8	Cap, cer, .01 µF 20% 100 V	10000-11	1
DS5	F-6	Light, Indicator, 18 V 26 mA	11387-1	4
DS6	F-6	Light, Indicator, 18 V 26 mA	11387-1	Ref
DS7	E-8	Light, Indicator, 18 V 26 mA	11387-1	Ref
DS8	F-4	Light, Indicator, 18 V 26 mA	11387-1	Ref
J2	E-9	Receptacle, BNC	11504	1
J3	D-6	Receptacle, BNC	11689	2
J6	D-9	Receptacle, BNC	11689	Ref
R1	E-3	Res, var, 100 KΩ 20% 25 turns	11688-1	2
R3	E-3	Res, var, 100 KΩ 20% 25 turns	11688-1	Ref
R4	D-5	Res, car flm, 4.7 KΩ 5% 1/4 W	10013-33	1
R5	D-5	Res, car flm, 470 Ω 5% 1/4 W	10013-21	1
R6	D-5	Res, car flm, 100 Ω 5% 1/4 W	10013-13	2
R7	D-5	Res, var, 1/5 KΩ 20% 1/2 W	10095-3	1
R8	D-5	Res, car flm, 100 Ω 5% 1/4 W	10013-13	Ref
R9	E-5	Potentiometer, WW, 5 KΩ 10 Turn with Dial	12497-1	1
R10	D-8	Res, var, 10 KΩ 20% 1/2 W with switch	12647	1
S1	F-9	Switch, Toggle, DPDT	10057	1
S3	D-5	Switch, Lever, 5P3T	10450	5
S4	D-6	Switch, Lever, 5P3T	10450	Ref
S5	D-8	Switch, Pushbutton, SPDT	10058	1
S6	D-3	Switch, Lever, 5P3T	10450	Ref
S7	D-4	Switch, Lever, 5P3T	10450	Ref
S9	D-7	Switch, Lever, 5P3T	10450	Ref
	A-4	Lamp Base	11385	4
	A-4	Cap, White	11386-1	3
	A-6	Cap, Red	11386-2	1
	A-3	Knob, Pushbutton	11536	4
	B-2	Knob, Pushbutton	11683	4
	C-8	Knob, Panel	10803-1	2
	B-4	Knob, Panel	10804-1	1
	F-7	Polaroid	10841-2	1
	F-7	Bracket, Polaroid	11144	1
	B-5	Dial, Turns Counting	11177	1

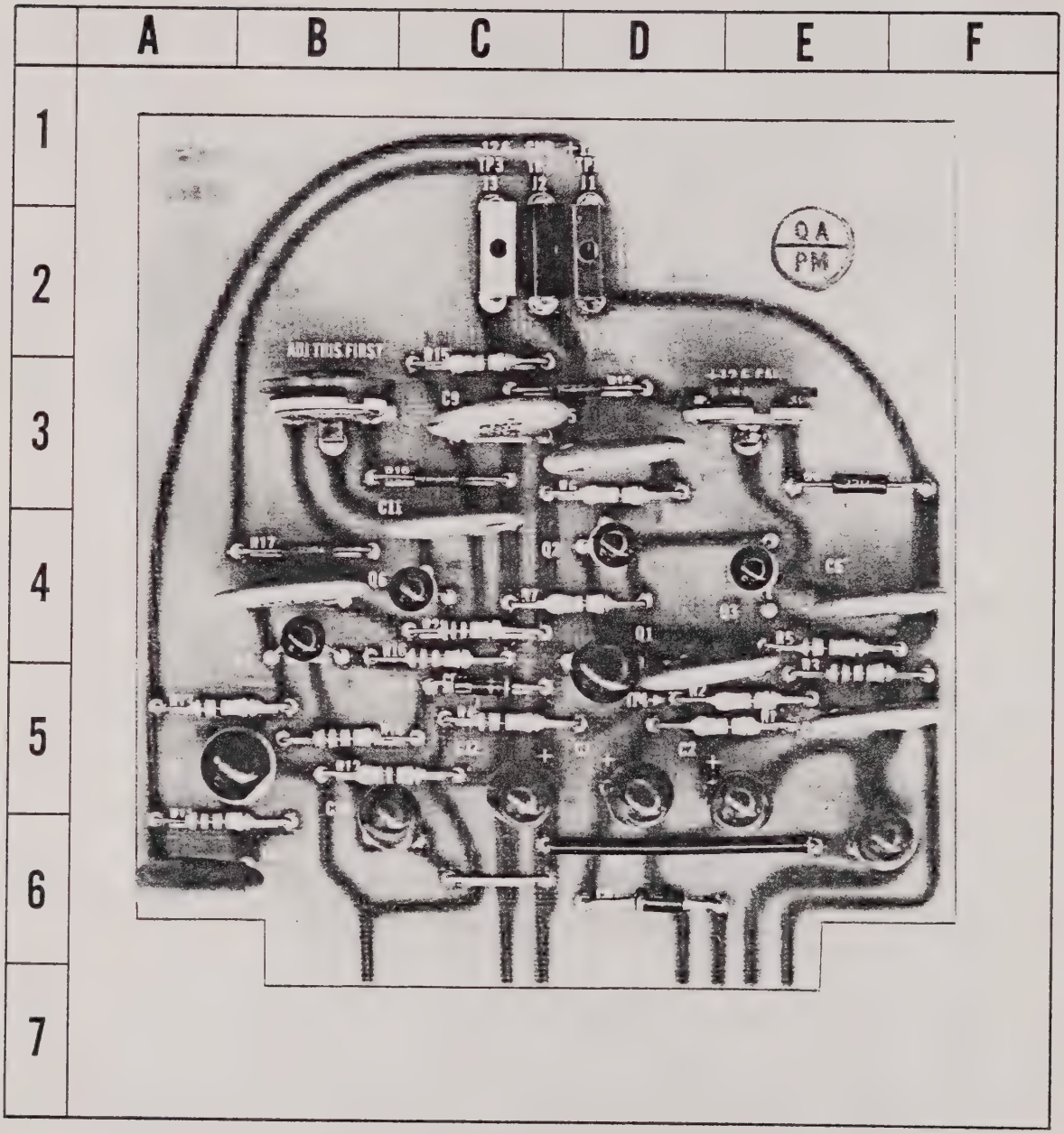


FRONT PANEL ASSEMBLY
FIGURE 7-2

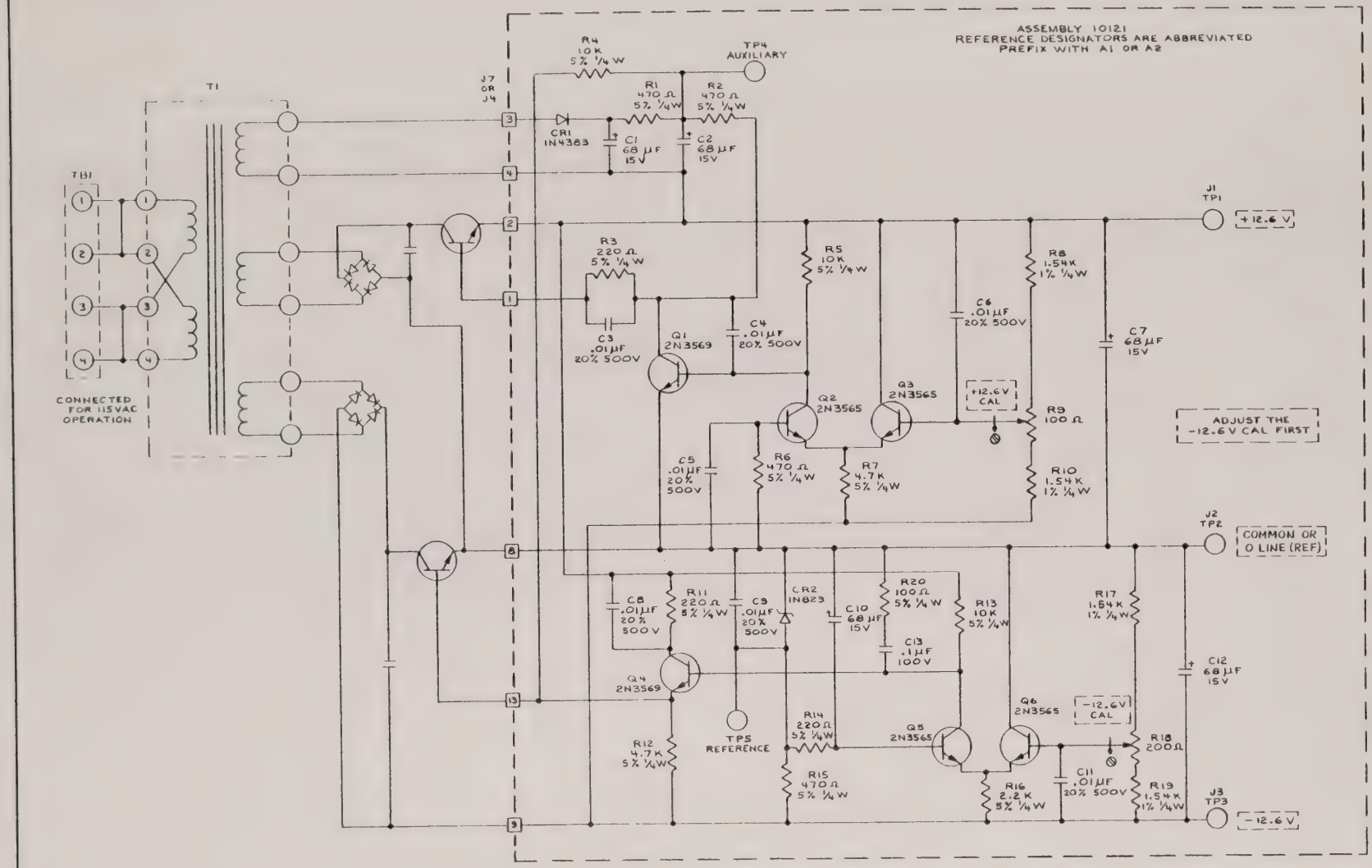

A10 ASSY 12088
CAL FACTOR SWITCH ASSY
CAL FACTOR - dB
A9 ASSY 12125
POWER DETECTOR
AMPLIFIER ASSY
RF INPUT
A3
PREAMP & POLARITY
A1
±12.6V POWER SUPPLY
A5 ASSY 12103
T1
S1
POWER
S2
115V
230V
F1
0.5A
J1
A4
ASSY 12042
INPUT CIRCUIT
A2 ASSY 12047
RANGE SWITCH & LAMP DRIVERS
A7
ASSY 11354
DIGITAL DISPLAY
ASSY 12211
A6
ASSY 12072
TRIGGER CKT
A8
ASSY 12136
CALIBRATOR
CAL FACTOR
+10dBm CAL
-20dBm CAL
OVERRANGE
INPUT
OUTPUT
SAMPLER TRIG INPUT
POLARITY
PRINT COMMAND
SIG GND
+3.6V
-12.6V
+12.6V
+15V UNREG
P.S. GND
TO R1 (CW)
A5 PIN 17
A5 PIN 25
A5 PIN 2
A5 PIN 9
A4 PIN 1
A4 PIN 44
POLARITY ON-OFF
10⁻¹
10⁻²
10⁻³
0.1
0.2
0.4
0.8
1.0
dB OFFSET
PULSE AVERAGING
1. OFF
2. ON
3. ON MAX RESET
INTERNAL TRIGGER LEVEL-dBm
1. -15 TO -25
2. -5 TO -15
3. >-5
OUTPUT REF PULSE
TRIGGER
1. FREE RUN
2. INT
3. EXT
MANUAL
RATE
TRIGGER DELAY-μs
MONITOR OUTPUT
TRIGGER INPUT
CALIBRATOR OUTPUT 100 MHz
CALIBRATOR
1. OFF
2. -20 dBm 10μW
3. +10 dBm 10mW
TRIGGER RESET
RESET
NEW DATA
INPUT
Q1 40250
Q2 40250
Q3 40290
Q4 2N3565
Q1 2N5833
Q2 2N3569
CR1 IN4148
CR15 IN5276B
CR19 IN5276B
R1 100K 25T
R3 100K 25T
R4 4.7K
R5 470
R6 100
R7 15K
R8 100
R9 5K
R10 10K
R11 3.3K
R12 3.48K 1%
R13 500
R14 2.00K 1%
C1 01
C2 5.0
S3
S4
S5
S6
S7
S8
S9
S10
J2
J3
J4
J5
J6
J7
DS1
DS2
DS3
DS4
DS5
DS6
DS7
DS8
DS9
NOTE
1. -12.6V WIRED TO TB3 PINS 1 & 2
+12.6V WIRED TO TB3 PINS 3 & 4
(1) WIRED TO TB2 PINS 3 & 4
(2) WIRED TO TB2 PINS 1 & 2
2. SWITCH S10 IS PART OF POTENTIOMETER R10
LIST OF MATERIAL
NEXT ASSY
PACIFIC MEASUREMENTS INCORPORATED
LOG/LIN RF PEAK POWER METER
12087
B
SHEET 1 OF 1
YO
1-10-72
NB
6-21-72

REPLACEABLE PARTS LIST

REF. DESIG.	LOCATION	DESCRIPTION	DM PART NO.	TOT. QTY.
		POWER SUPPLY PC BOARD ASSEMBLY - 10121 (Refer to Fig. 7-3)		
A1C1	D-5	Cap, Ta, 68 µF 20% 15 V	10787-4	5
A1C2	E-5	Cap, Ta, 68 µF 20% 15 V	10787-4	Ref
A1C3	E-5	Cap, cer, .01 µF 20% 500 V	10000-7	7
A1C4	D-5	Cap, cer, .01 µF 20% 500 V	10000-7	Ref
A1C5	D-3	Cap, cer, .01 µF 20% 500 V	10000-7	Ref
A1C6	E-4	Cap, cer, .01 µF 20% 500 V	10000-7	Ref
A1C7	E-6	Cap, Ta, 68 µF 20% 15 V	10787-4	Ref
A1C8	A-6	Cap, cer, .01 µF 20% 500 V	10000-7	Ref
A1C9	C-3	Cap, cer, .01 µF 20% 500 V	10000-7	Ref
A1C10	C-6	Cap, Ta, 68 µF 20% 15 V	10787-4	Ref
A1C11	C-4	Cap, cer, .01 µF 20% 500 V	10000-7	Ref
A1C12	C-5	Cap, Ta, 68 µF 20% 15 V	10787-4	Ref
A1C12	B-4	Cap, cer, 0.1 µF +80%-20% 100 V	10000-10	1
A1CR1	D-6	Diode, 1N4383	10044-1	1
A1CR2	C-5	Diode, 1N823	10045	1
A1J1	D-2	Test Jack, Red	10054-2	1
A1J2	C-2	Test Jack, Black	10054-1	1
A1J3	C-2	Test Jack, Blue	10054-3	1
A1Q1	D-5	Transistor, 2N3569	10017	2
A1Q2	D-4	Transistor, 2N3565	10019	4
A1Q3	E-4	Transistor, 2N3565	10019	Ref
A1Q4	A-5	Transistor, 2N3569	10017	Ref
A1Q5	B-4	Transistor, 2N3565	10019	Ref
A1Q6	C-4	Transistor, 2N3565	10019	Ref
A1R1	E-5	Res, car flm, 470 Ω 5% 1/4 W	10013-21	4
A1R2	E-5	Res, car flm, 470 Ω 5% 1/4 W	10013-21	Ref
A1R3	E-5	Res, car flm, 220 Ω 5% 1/4 W	10013-17	3
A1R4	C-5	Res, car flm, 10 KΩ 5% 1/4 W	10013-37	3
A1R5	E-4	Res, car flm, 10 KΩ 5% 1/4 W	10013-37	Ref
A1R6	D-3	Res, car flm, 470 Ω 5% 1/4 W	10013-21	Ref
A1R7	C-4	Res, car flm, 4.7 KΩ 5% 1/4 W	10013-33	2
A1R8	E-3	Res, met flm, 1.54 KΩ 1% 1/4 W	10015-1	4
A1R9	E-3	Res, var comp, 100 Ω 20% 1/4 W	10046-9	1
A1R10	D-3	Res, met flm, 1.54 KΩ 1% 1/4 W	10015-1	Ref
A1R11	A-5	Res, car flm, 220 Ω 5% 1/4 W	10013-17	Ref
A1R12	B-5	Res, car flm, 4.7 KΩ 5% 1/4 W	10013-33	Ref
A1R13	A-5	Res, car flm, 10 KΩ 5% 1/4 W	10013-37	Ref
A1R14	B-5	Res, car flm, 220 Ω 5% 1/4 W	10013-17	Ref
A1R15	C-2	Res, car flm, 470 Ω 5% 1/4 W	10013-21	Ref
A1R16	C-4	Res, car flm, 2.2 KΩ 5% 1/4 W	10013-29	1
A1R17	B-4	Res, met flm, 1.54 KΩ 1% 1/4 W	10015-1	Ref
A1R18	B-3	Res, var comp, 200 Ω 20% 1/4 W	10046-6	1
A1R19	C-3	Res, met flm, 1.54 KΩ 1% 1/4 W	10015-1	Ref
A1R20	C-4	Res, car flm, 100 Ω 5% 1/4 W	10013-13	1



±12.6V POWER SUPPLY BOARD ASSEMBLY
FIGURE 7-3

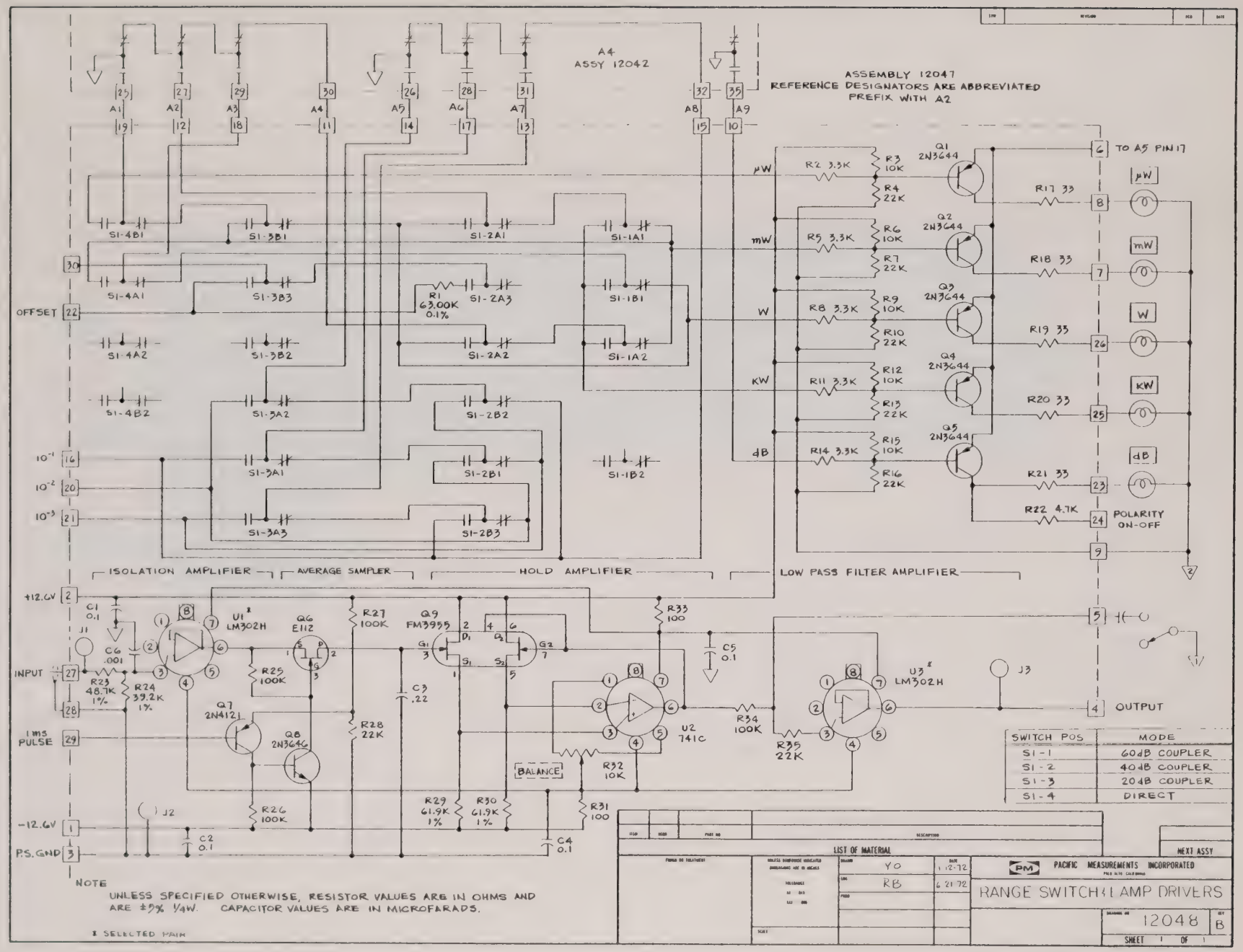


PACIFIC MEASUREMENTS		
SCALE ---	APPROVED BY: Wm. A. Hall	DRAWN BY AHO
DATE 1-11-67		REVISED
±12.6 VOLT POWER SUPPLY		DRAWING NUMBER 10420

REPLACEABLE PARTS LIST				
REF. DESIG.	LOCA-TION	DESCRIPTION	HP PART NO.	TOT. QTY.
		RANGE SWITCH PC BOARD ASSEMBLY - 12047 (Refer to Fig. 7-4)		
A2C1	B-1	Cap, cer, 0.1 µF +80%-20% 100 V	100000-10	4
A2C2	B-1	Cap, cer, 0.1 µF +80%-20% 100 V	100000-10	Ref
A2C3	A-3	Cap, mylar, 0.22 µF 10% 200 V	10007-8	1
A2C4	A-1	Cap, cer, 0.1 µF +80%-20% 100 V	10000-10	Ref
A2C5	B-2	Cap, cer, 0.1 µF +80%-20% 100 V	10000-10	Ref
A2C6	B-4	Cap, cer, .001 µF ±20% 1000 V	10000-4	1
A2J1	B-5	Test Jack, Yellow	10140-2	2
A2J2	A-1	Test Jack, Black	10140-3	1
A2J3	A-2	Test Jack, Yellow	10140-2	Ref
A2Q1	A-6	Transistor, 2N3644	10023	5
A2Q2	A-6	Transistor, 2N3644	10023	Ref
A2Q3	A-4	Transistor, 2N3644	10023	Ref
A2Q4	A-5	Transistor, 2N3644	10023	Ref
A2Q5	A-5	Transistor, 2N3644	10023	Ref
A2Q6	A-3	Transistor, E112	12591	1
A2Q7	B-4	Transistor, 2N4121	10398	1
A2Q8	B-3	Transistor, 2N3646	10018	1
A2Q9	B-3	Transistor, FM3955	11432	1
A2R1	B-6	Res, met film, 63.00 KΩ 0.1% 1/4 W	11485-13	1
A2R2	A-7	Res, car film, 3.3 KΩ 5% 1/4 W	10013-31	5
A2R3	B-6	Res, car film, 10 KΩ 5% 1/4 W	10013-37	5
A2R4	B-6	Res, car film, 22 KΩ 5% 1/4 W	10013-41	7
A2R5	A-6	Res, car film, 3.3 KΩ 5% 1/4 W	10013-31	Ref
A2R6	B-6	Res, car film, 10 KΩ 5% 1/4 W	10013-37	Ref
A2R7	B-6	Res, car film, 22 KΩ 5% 1/4 W	10013-41	Ref
A2R8	A-4	Res, car film, 3.3 KΩ 5% 1/4 W	10013-31	Ref
A2R9	B-4	Res, car film, 10 KΩ 5% 1/4 W	10013-37	Ref
A2R10	B-4	Res, car film, 22 KΩ 5% 1/4 W	10013-41	Ref
A2R11	A-5	Res, car film, 3.3 KΩ 5% 1/4 W	10013-31	Ref
A2R12	B-5	Res, car film, 10 KΩ 5% 1/4 W	10013-37	Ref
A2R13	B-5	Res, car film, 22 KΩ 5% 1/4 W	10013-41	Ref
A2R14	A-5	Res, car film, 3.3 KΩ 5% 1/4 W	10013-31	Ref
A2R15	B-5	Res, car film, 10 KΩ 5% 1/4 W	10013-37	Ref
A2R16	B-5	Res, car film, 22 KΩ 5% 1/4 W	10013-41	Ref
A2R17	B-6	Res, car film, 33 Ω 5% 1/4 W	10013-7	5
A2R18	B-6	Res, car film, 33 Ω 5% 1/4 W	10013-7	Ref
A2R19	A-4	Res, car film, 33 Ω 5% 1/4 W	10013-7	Ref
A2R20	B-5	Res, car film, 33 Ω 5% 1/4 W	10013-7	Ref
A2R21	B-5	Res, car film, 33 Ω 5% 1/4 W	10013-7	Ref
A2R22	B-5	Res, car film, 4.7 KΩ 5% 1/4 W	10013-33	1
A2R23	B-4	Res, met film, 48.7 KΩ 1% 1/4 W	10015-41	1
A2R24	B-4	Res, met film, 39.2 KΩ 1% 1/4 W	10015-61	1
A2R25	A-3	Res, car film, 100 KΩ 5% 1/4 W	10013-49	4
A2R26	B-3	Res, car film, 100 KΩ 5% 1/4 W	10013-49	Ref
A2R27	B-3	Res, car film, 100 KΩ 5% 1/4 W	10013-49	Ref
A2R28	B-3	Res, car film, 22 KΩ 5% 1/4 W	10013-41	Ref
A2R29	B-2	Res, met film, 61.9 KΩ 1% 1/4 W	10015-25	2
A2R30	B-3	Res, car film, 61.9 KΩ 1% 1/4 W	10015-25	Ref
A2R31	B-1	Res, car film, 100 Ω 5% 1/4 W	10013-13	2
A2R32	A-2	Res, var comp, 10 KΩ 20% 1/4 W	10046-8	1

REPLACEABLE PARTS LIST

REF. DESIG.	LOCATION	DESCRIPTION	HP PART NO.	TOT. QTY.
A2R33	B-2	Res, car flm, 100 Ω 5% 1/4 W	10013-13	Ref
A2R34	B-2	Res, car flm, 100 KΩ 5% 1/4 W	10013-49	Ref
A2R35	A-2	Res, car flm, 22 KΩ 5% 1/4 W	10013-41	Ref
A2S1	C-8	Switch, Pushbutton	12026	1
A2U1	A-4	IC, Voltage Follower (1/2 Selected Pair - See A2U3)	12395	1
A2U2	B-2	IC, Op Amp	11539	1
A2U3	A-2	IC, Voltage Follower (1/2 Selected Pair - See A2U1)		Ref



SWITCH POS	MODE
S1-1	60dB COUPLER
S1-2	40dB COUPLER
S1-3	20dB COUPLER
S1-4	DIRECT

NOTE
UNLESS SPECIFIED OTHERWISE, RESISTOR VALUES ARE IN OHMS AND ARE ±5% ¼W. CAPACITOR VALUES ARE IN MICROFARADS.

‡ SELECTED PAIR

LIST OF MATERIAL

NEXT ASSY

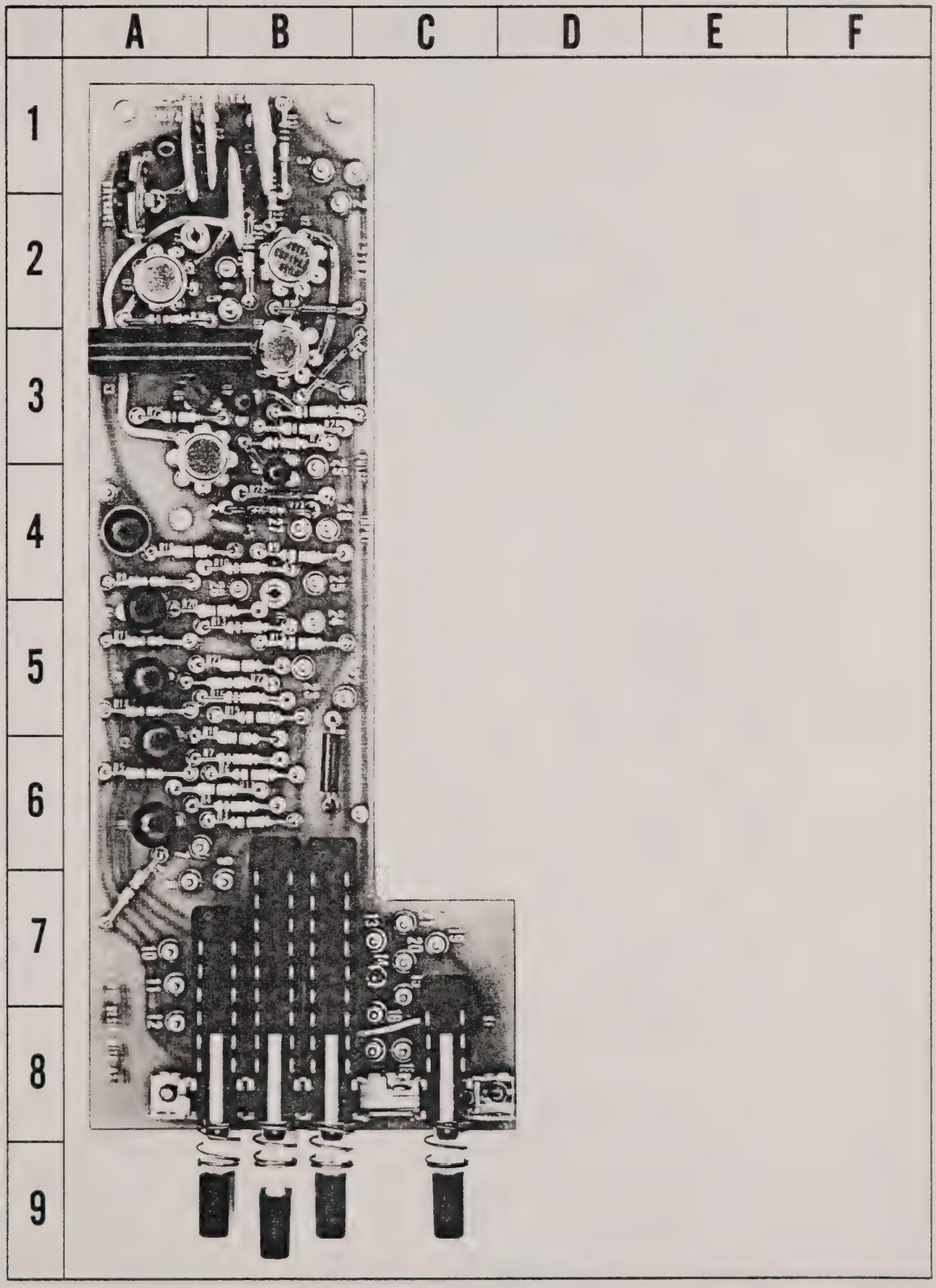
PACIFIC MEASUREMENTS INCORPORATED

DRAWN	YO	1-12-72
CHK	RB	6-21-72

RANGE SWITCH & AMP DRIVERS

12048 B

SHEET 1 OF 1



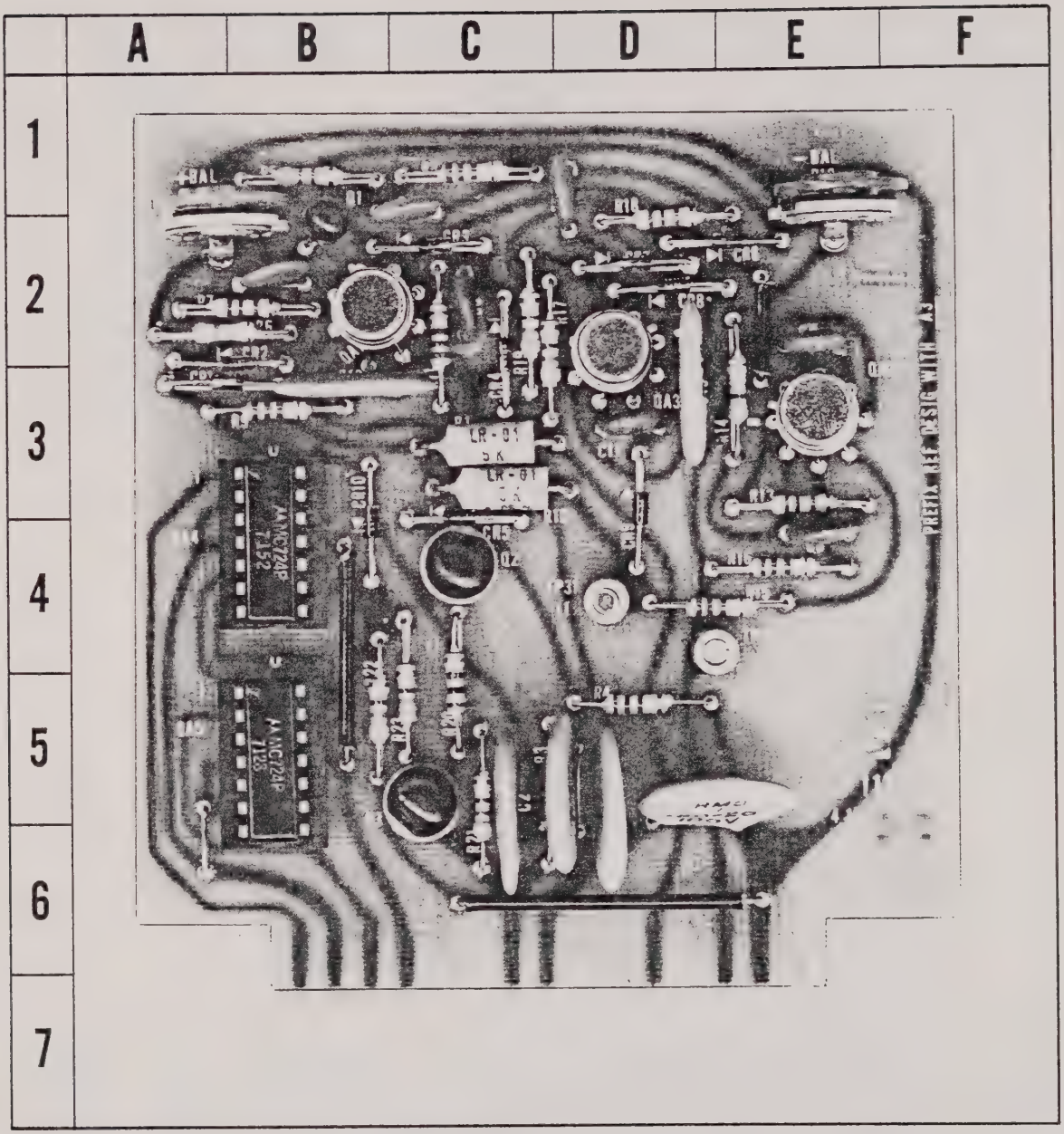
RANGE SWITCH BOARD ASSEMBLY
FIGURE 7-4

REPLACEABLE PARTS LIST

REF. DESIG.	LOCATION	DESCRIPTION	PART NO.	TOT. QTY.
		PREAMP & POLARITY SENSING PC BOARD ASSEMBLY - 11214 (Refer to Fig. 7-5)		
A3C1	D-6	Cap, cer, 0.1 µF +80%-20% 100 V	10000-10	6
A3C2	C-6	Cap, cer, 0.1 µF +80%-20% 100 V	10000-10	Ref
A3C3	D-6	Cap, cer, 0.1 µF +80%-20% 100 V	10000-10	Ref
A3C4	-	Not Used		
A3C5	B-2	Cap, cer, .0047 µF 20% 500 V	10000-6	3
A3C6	C-2	Cap, cer, 220 pF 20% 1000 V	10000-2	3
A3C7	D-6	Cap, cer, 0.1 µF +80%-20% 100 V	10000-10	Ref
A3C8	E-4	Cap, cer, .0047 µF 20% 500 V	10000-6	Ref
A3C9	E-2	Cp, cer, 220 pF 20% 1000 V	10000-2	Ref
A3C10	D-1	Cap, cer, .0047 µF 20% 500 V	10000-6	Ref
A3C11	D-3	Cap, cer, 220 pF20% 1000 V	10000-2	Ref
A3C12	B-3	Cap, cer, 0.1 µF +80%-20% 100 V	10000-10	Ref
A3C13	D-3	Cap, cer, 0.1 µF +80%-20% 100 V	10000-10	Ref
A3CR1	A-3	Diode, 1N4148	10043	9
A3CR2	A-2	Diode, 1N4148	10043	Ref
A3CR3	-	Not Used	10043	
A3CR4	C-3	Diode, 1N4148	10043	Ref
A3CR5	C-4	Diode, 1N4148	10043	Ref
A3CR6	E-2	Diode, 1N4148	10043	Ref
A3CR7	D-2	Diode, 1N4148	10043	Ref
A3CR8	D-2	Diode, 1N4148	10043	Ref
A3CR9	D-4	Diode, 1N4148	10043	Ref
A3CR10	B-4	Diode, 1N4148	10043	Ref
A3J1	D-4	Test Jack, Yellow	10140-2	2
A3J2	E-5	Test Jack, Yellow	10140-2	Ref
A3Q1	-	Not Used		
A3Q2	C-4	Transistor, 2N3644	10023	1
A3Q3	B-6	Transistor, 2N3569	10017	1
A3QA1	B-2	IC, Op Amp	10769	3
A3QA2	E-3	IC, Op Amp	10769	Ref
A3QA3	D-3	IC, Op Amp	10769	Ref
A3QA4	B-4	IC, Quad 2 Input Gate	10722-1	2
A3QA5	B-5	IC, Quad 2 Input Gate	10722-1	Ref
A3R1	C-3	Res, WW, 5.00 KΩ .05% 1/8 W	10725-2	2
A3R2	A-2	Res, var comp, 100 KΩ 20% 1/4 W	10046-10	2
A3R3	C-5	Res, car flm, 10 Ω 5% 1/4 W	10013-1	2
A3R4	D-5	Res, car flm, 10 Ω 5% 1/4 W	10013-1	Ref
A3R5	-	Not Used		
A3R6	A-2	Res, car flm, 470 KΩ 5% 1/4 W	10013-57	2
A3R7	A-2	Res, car flm, 1.5 KΩ 5% 1/4 W	10013-27	3
A3R8	-	Not Used		
A3R9	B-3	Res, car flm, 2.2 KΩ 5% 1/4 W	10013-29	4
A3R10	C-3	Res, WW, 5.00 KΩ .05% 1/8 W	10725-2	Ref
A3R11	C-3	Res, car flm, 2.2 KΩ 5% 1/4 W	10013-29	Ref
A3R12	E-2	Res, var comp, 100 KΩ 20% 1/4 W	10046-10	Ref

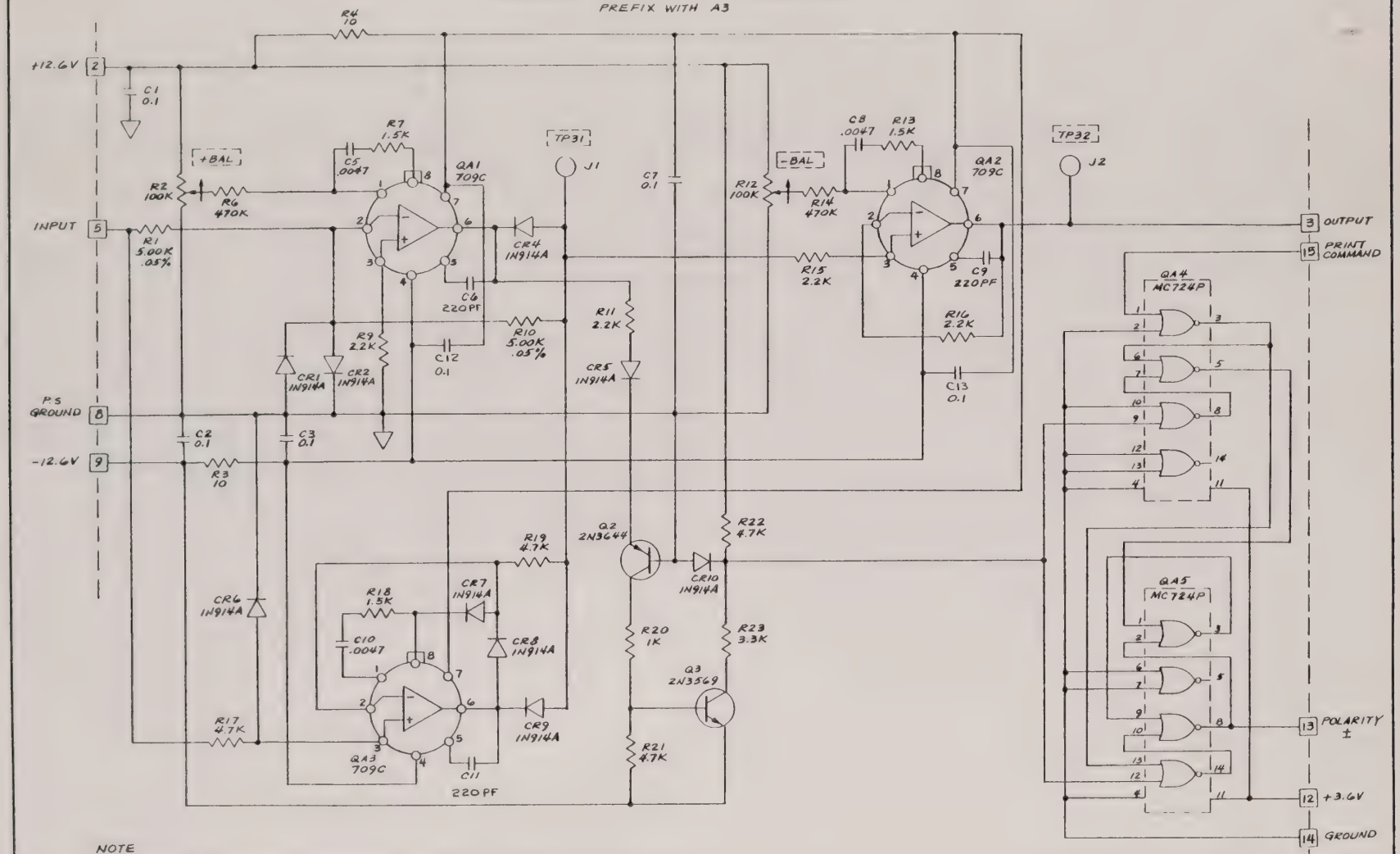
REPLACEABLE PARTS LIST

REF. DESIG.	LOCATION	DESCRIPTION	HP PART NO.	TOT. QTY.
A3R13	E-3	Res, car flm, 1.5 KΩ 5% 1/4 W	10013-27	Ref
A3R14	E-3	Res, car flm, 470 KΩ 5% 1/4 W	10013-57	Ref
A3R15	E-4	Res, car flm, 2.2 KΩ 5% 1/4 W	10013-29	Ref
A3R16	E-4	Res, car flm, 2.2 KΩ 5% 1/4 W	10013-29	Ref
A3R17	C-2	Res, car flm, 4.7 KΩ 5% 1/4 W	10013-33	4
A3R18	D-2	Res, car flm, 1.5 KΩ 5% 1/4 W	10013-27	Ref
A3R19	C-2	Res, car flm, 4.7 KΩ 5% 1/4 W	10013-33	Ref
A3R20	C-5	Res, car flm, 1 KΩ 5% 1/4 W	10013-25	1
A3R21	C-6	Res, car flm, 4.7 KΩ 5% 1/4 W	10013-33	Ref
A3R22	B-5	Res, car flm, 4.7 KΩ 5% 1/4 W	10013-33	Ref
A3R23	B-5	Res, car flm, 3.3 KΩ 5% 1/4 W	10013-31	1
		Socket, IC 14 Pin	10978-1	2



PREAMP AND POLARITY BOARD ASSEMBLY
FIGURE 7-5

ASSEMBLY 11214
REFERENCE DESIGNATORS ARE ABBREVIATED
PREFIX WITH A3



NOTE

UNLESS OTHERWISE SPECIFIED, RESISTOR VALUES ARE IN OHMS AND ARE 5% 1/4 WATT. CAPACITOR VALUES ARE IN MICROFARADS.

PACIFIC MEASUREMENTS INCORPORATED

SCALE:	APPROVED BY: R. Bittleman 2-5-70	DRAWN BY Y.O.
DATE: 7-31-69		REVISED

PREAMP AND POLARITY SENSING CKT

DRAWING NUMBER 11215 REV B

REPLACEABLE PARTS LIST

REF. DESIG.	LOCATION	DESCRIPTION	GRC PART NO.	TOT. QTY.
		INPUT CIRCUIT PC BOARD ASSEMBLY - 12042 (Refer to Fig. 7-6)		
A4C1	F-4	Cap, cer, .01 µF 20% 100 V	10000-11	12
A4C2	F-4	Cap, cer, .01 µF 20% 100 V	10000-11	Ref
A4C3	A-1	Cap, cer, 0.1 µF 20% 500 V	10000-7	2
A4C4	F-5	Cap, cer, .01 µF 20% 100 V	10000-11	Ref
A4C5	E-3	Cap, cer, 0.1 µF +80%-20% 100 V	10000-10	9
A4C6	F-4	Cap, cer, 0.1 µF 20% 100 V	10000-11	Ref
A4C7	E-3	Cap, cer, 0.1 µF +80%-20% 100 V	100010	Ref
A4C8	*	Cap, cer, .01 µF 20% 100 V	10000-11	Ref
A4C9	A-2	Cap, cer, 0.1 µF +80%-20% 100 V	10000-10	Ref
A4C10	B-1	Cap, cer, 0.1 µF +80%-20% 100 V	10000-10	Ref
A4C11	A-2	Cap, Ta, 4.7 µF 20% 35 V	10787-1	1
A4C12	A-2	Cap, cer, 0.1 µF +80%-20% 100 V	10000-10	Ref
A4C13	B-3	Cap, cer, 0.1 µF +80%-20% 100 V	10000-10	Ref
A4C14	B-2	Cap, cer, 0.1 µF +80%-20% 100 V	10000-10	Ref
A4C15	-	Not Used		
A4C16	B-4	Cap, cer, 68 pF 5% 1000 V	10001-14	1
A4C17	C-3	Cap, cer, .0022 µF 20% 500 V	10000-5	3
A4C18	-	Not Used		
A4C19	D-2	Cap, cer, 0.1 µF +80%-20% 100 V	10000-10	Ref
A4C20	D-3	Cap, cer, 150 pF 5% 1000 V	10001-15	1
A4C21	D-2	Cap, cer, 470 pF 20% 1000 V	10000-3	1
A4C22	D-2	Cap, cer, 0.1 µF +80%-20% 100 V	10000-10	Ref
A4C23	D-3	Cap, cer, .01 µF 20% 100 V	10000-11	Ref
A4C24	C-2	Cap, mica, .0025 µF 5% 500 V	10677-3	1
A4C25	C-1	Cap, cer, .0022 µF 20% 500 V	10000-5	Ref
A4C26	C-1	Cap, cer, .0022 µF 20% 500 V	10000-5	Ref
A4C27	B-1	Cap, cer, .01 µF 20% 500 V	10000-7	Ref
A4C28	D-2	Cap, cer, 10 pF 5% 1000 V	10001-3	1
A4C29	-	Not Used		
A4C30	C-5	Cap, mylar, .047 µF 10% 200 V	10007-6	1
A4C31	C-4	Cap, cer, .01 µF 20% 100 V	10000-11	Ref
A4C32	C-4	Cap, cer, .01 µF 20% 100 V	10000-11	Ref
A4C33	A-5	Cap, mylar, 0.1 µF 10% 200 V	10007-7	3
A4C34	B-5	Cap, mylar, 0.1 µF 10% 200 V	10007-7	Ref
A4C35	B-5	Cap, mylar, .001 µF 10% 200 V	10007-1	1
A4C36	B-4	Cap, cer, 100 pF 20% 1000 V	10000-1	3
A4C37	B-4	Cap, cer, .01 µF 20% 100 V	10000-11	Ref
A4C38	B-5	Cap, mylar, 0.1 µF 10% 200 V	10007-7	Ref
A4C39	B-4	Cap, cer, .01 µF 20% 100 V	10000-11	Ref
A4C40	B-5	Cap, Ta, 1.0 µF 20% 35 V	10787-5	1
A4C41	B-5	Cap, cer, 100 pF 20% 1000 V	10000-1	Ref
A4C42	A-4	Cap, cer, .01 µF 20% 100 V	10000-11	Ref
A4C43	B-4	Cap, cer, 100 pF 20% 1000 V	10000-1	Ref
A4C44	B-4	Cap, cer, .01 µF 20% 100 V	10000-11	Ref
A4C45	A-5	Cap, cer, 47 pF 5% 1000 V	10001-6	1
A4C46	A-5	Cap, mylar, .022 µF 10% 200 V	10007-5	1
A4C47	A-3	Cap, Ta, 27 µF 20% 15 V	10787-3	1
A4C48	*	Cap, cer, 22 pF ± 5% 1000 V	10001-4	1
A4CR1	D-4	Diode, 1N4148	10043	17
A4CR2	E-3	Diode, 1N4148	10043	Ref
A4CR3	B-6	Diode, 1N4148	10043	Ref
A4CR4	-	Not Used		

* Not Illustrated

REPLACEABLE PARTS LIST

REF. DESIG.	LOCA-TION	DESCRIPTION	HP PART NO.	TOT. QTY.
A4CR5	B-3	Diode, 1N4148	10043	Ref
A4CR6	B-3	Diode, 1N4148	10043	Ref
A4CR7	D-3	Diode, 1N4148	10043	Ref
A4CR8	D-3	Diode, 1N4148	10043	Ref
A4CR9	C-1	Diode, 1N4148	10043	Ref
A4CR10	C-1	Diode, 1N4148	10043	Ref
A4CR11	E-1	Diode, 1N4148	10043	Ref
A4CR12	E-2	Diode, 1N4148	10043	Ref
A4CR13	E-2	Diode, 1N4148	10043	Ref
A4CR14	E-2	Diode, 1N4148	10043	Ref
A4CR15	E-3	Diode, 1N4148	10043	Ref
A4CR16	E-3	Diode, 1N4148	10043	Ref
A4CR17	E-3	Diode, 1N4148	10043	Ref
A4CR18	E-3	Diode, 1N4148	10043	Ref
A4J1	D-4	Test Jack, Yellow	10140-2	10
A4J2	E-5	Test Jack, Yellow	10140-2	Ref
A4J3	E-5	Test Jack, Black	10140-3	1
A4J4	D-5	Test Jack, Yellow	10140-2	Ref
A4J5	D-4	Test Jack, Yellow	10140-2	Ref
A4J6	B-4	Test Jack, Yellow	10140-2	Ref
A4J7	D-2	Test Jack, Yellow	10140-2	Ref
A4J8	A-1	Test Jack, Yellow	10140-2	Ref
A4J9	A-4	Test Jack, Yellow	10140-2	Ref
A4J10	D-4	Test Jack, Yellow	10140-2	Ref
A4J11	D-2	Test Jack, Yellow	10140-2	Ref
A4L1	D-3	Coil, RF 18 µH 10%	10631-2	1
A4Q1	E-4	Transistor, FM3955	11432	3
A4Q2	E-5	Transistor, 2N4121	10398	4
A4Q3	D-5	Transistor, 2N3646	11457	1
A4Q4	D-5	Transistor, 2N3053	10206	1
A4Q5	D-4	Transistor, 2N3644	10023	1
A4Q6	A-6	Transistor, 2N3569	10017	2
A4Q7	-	Not Used		
A4Q8	B-3	Transistor, TIS97	11507	1
A4Q9	D-4	Transistor, 3N138	10896	4
A4Q10	C-3	Transistor, FM3955	11432	Ref
A4Q11	C-3	Transistor, 2N3565	10019	4
A4Q12	C-3	Transistor, 2N4250	11119	5
A4Q13	C-3	Transistor, 2N4250	11119	Ref
A4Q14	C-3	Transistor, 2N3569	10017	Ref
A4Q15	D-3	Transistor, 2N4121	10398	Ref
A4Q16	-	Not Used		
A4Q17	D-2	Transistor, 2N3646	10018	1
A4Q18	C-2	Transistor, E112	12591	2
A4Q19	C-2	Transistor, FM3955	11432	Ref
A4Q20	C-2	Transistor, 2N3565	10019	Ref
A4Q21	C-2	Transistor, 2N4250	11119	Ref
A4Q22	B-2	Transistor, 2N4250	11119	Ref
A4Q23	B-2	Transistor, 2N3440	11433	2
A4Q24	B-1	Transistor, 2N3440	11433	Ref

REPLACEABLE PARTS LIST

REF. DESIG.	LOCATION	DESCRIPTION	HP PART NO.	TOT. QTY.
A4Q25	-	Not Used		
A4Q26	C-4	Transistor, 2N4250	11119	Ref
A4Q27	C-5	Transistor, 2N3565	10019	Ref
A4Q28	C-5	Transistor, 2N3565	10019	Ref
A4Q29	B-5	Transistor, 3N138	10896	Ref
A4Q30	B-5	Transistor, 3N138	10896	Ref
A4Q31	B-5	Transistor, 2N4360	10339	1
A4Q32	A-4	Transistor, E112	12591	Ref
A4R1	F-4	Res, car flm, 100 Ω 5% 1/4 W	10013-13	10
A4R2	E-4	Res, met flm, 39.2 KΩ 1% 1/4 W	10015-61	3
A4R3	D-4	Res, car flm, 100 KΩ 5% 1/4 W	10013-49	5
A4R4	F-4	Res, car flm, 100 Ω 5% 1/4 W	10013-13	Ref
A4R5	E-4	Res, met flm, 61.9 KΩ 1% 1/4 W	10015-25	2
A4R6	E-5	Res, met flm, 61.9 KΩ 1% 1/4 W	10015-25	Ref
A4R7	E-4	Res, var comp, 10 KΩ 20% 1/4 W	10046-8	2
A4R8	F-6	Res, car comp, 1.5 MΩ 5% 1/4 W	10013-63	1
A4R9	F-5	Res, var comp, 1 MΩ 20% 1/4 W	10046-13	2
A4R10	F-5	Res, car flm, 100 Ω 5% 1/4 W	10013-13	Ref
A4R11	F-5	Res, car flm, 680 Ω 5% 1/4 W	10013-23	1
A4R12	E-5	Res, var comp, 1 KΩ 20% 1/4 W	10046-7	1
A4R13	E-5	Res, met flm, 5.62 KΩ 1% 1/4 W	10015-104	1
A4R14	F-4	Res, car flm, 100 Ω 5% 1/4 W	10013-13	Ref
A4R15	F-5	Res, met flm, 27.4 KΩ 1% 1/4 W	10015-48	1
A4R16	F-5	Res, met flm, 121 KΩ 1% 1/4 W	10015-43	1
A4R17	F-4	Res, var cerm, 100 KΩ 1/4 W	11711-2	1
A4R18	E-5	Res, met flm, 1.00 KΩ 1% 1/4 W	10015-19	2
A4R19	F-6	Res, met flm, 63.00 KΩ 0.1% 1/4 W	11485-13	1
A4R20	E-6	Res, WW, 17.555 KΩ .05% 1/8 W	10725-4	2
A4R21	C-6	Res, WW, 17.555 KΩ .05% 1/8 W	10725-4	Ref
A4R22	D-6	Res, WW, 158.00 KΩ .05% 1/8 W	10725-7	2
A4R23	D-6	Res, WW, 142.20 KΩ .05% 1/8 W	10725-5	1
A4R24	D-6	Res, WW, 158.00 KΩ .05% 1/8 W	10725-7	Ref
A4R25	E-6	Res, WW, 15.800 KΩ .05% 1/8 W	10725-8	1
A4R26	E-5	Res, car flm, 6.8 KΩ 5% 1/4 W	10013-35	1
A4R27	E-5	Res, car flm, 10 KΩ 5% 1/4 W	10013-37	2
A4R28	D-5	Res, car flm, 100 KΩ 5% 1/4 W	10013-49	Ref
A4R29	D-4	Res, met flm, 31.6 KΩ 1% 1/4 W	10015-14	1
A4R30	D-4	Res, car flm, 22 Ω 5% 1/4 W	10013-5	2
A4R31	D-4	Res, car flm, 1 KΩ 5% 1/4 W	10013-25	6
A4R32	D-4	Res, car flm, 2.2 KΩ 5% 1/4 W	10013-29	4
A4R33	D-4	Res, car flm, 3.3 KΩ 5% 1/4 W	10013-31	6
A4R34	D-4	Res, car flm, 1 KΩ 5% 1/2 W	10013-25	Ref
A4R35	C-6	Res, met flm, 1.00 KΩ 1% 1/4 W	10015-19	Ref
A4R36	C-6	Res, met flm, 21.5 KΩ 1% 1/4 W	10015-15	1
A4R37	C-6	Res, car flm, 150 KΩ 5% 1/4 W	10013-51	2
A4R38	C-5	Res, var comp, 100 KΩ 20% 1/4 W	10046-10	5
A4R39	A-6	Res, car flm, 3.3 KΩ 5% 1/4 W	10013-31	Ref
A4R40	A-6	Res, car flm, 1 KΩ 5% 1/4 W	10013-25	Ref
A4R41	A-6	Res, car flm, 220 Ω 5% 1/4 W	10013-17	2
A4R42	-	Not Used		
A4R43	-	Not Used		
A4R44	B-3	Res, car flm, 10 Ω 5% 1/4 W	10013-1	3
A4R45	B-3	Res, car flm, 100 Ω 5% 1/4 W	10013-13	Ref
A4R46	B-2	Res, car flm, 47 Ω 5% 1/4 W	10013-9	3

REPLACEABLE PARTS LIST

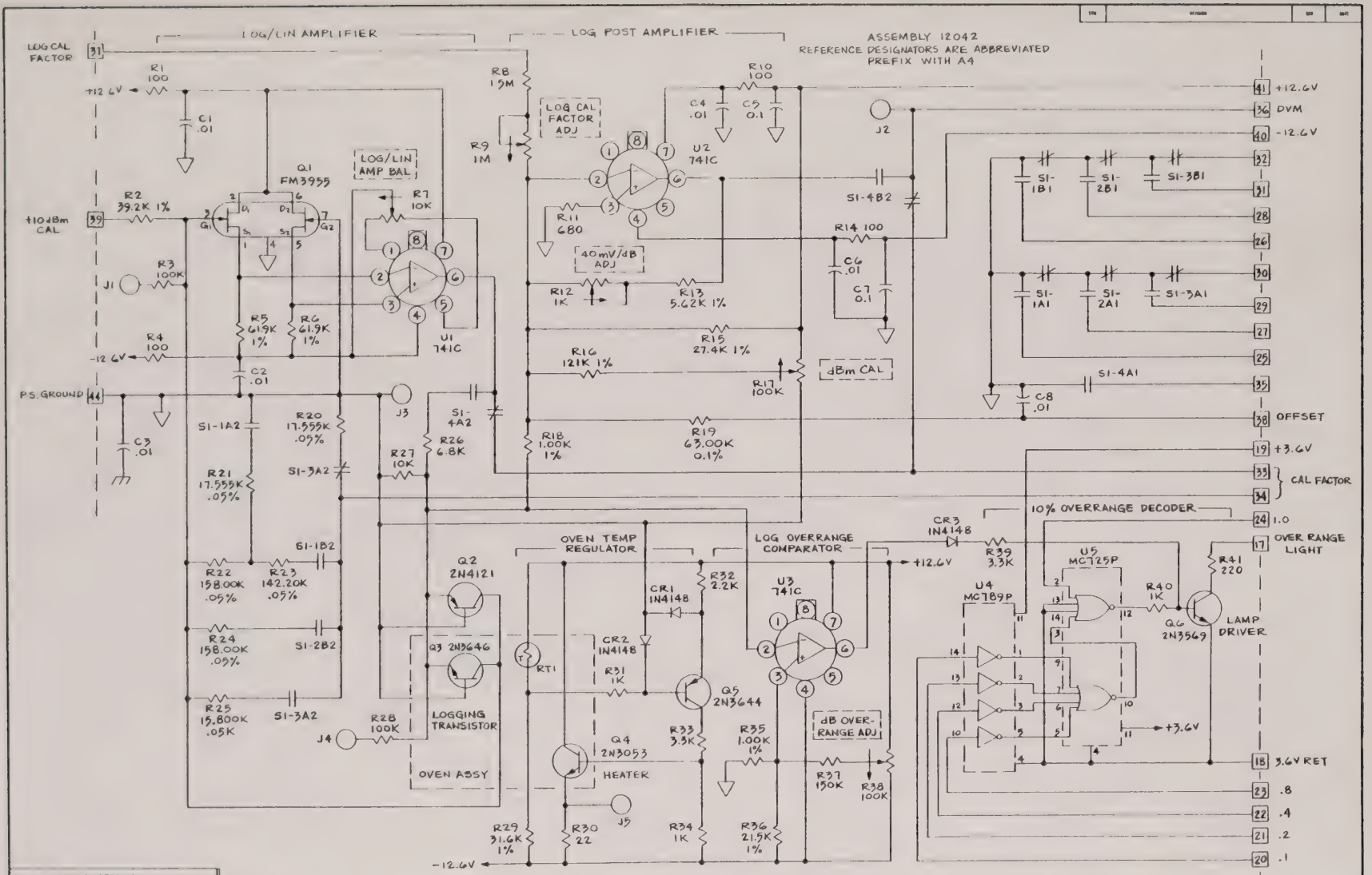
REF. DESIG.	LOCATION	DESCRIPTION	HP PART NO.	TOT. QTY.
A4R47	B-3	Res, car flm, 1.5 KΩ 5% 1/4 W	10013-27	2
A4R48	B-3	Res, car flm, 10 Ω 5% 1/4 W	10013-1	Ref
A4R49	B-3	Res, car comp, 10 MΩ 5% 1/4 W	10013-73	3
A4R50	C-3	Res, car flm, 47 Ω 5% 1/4 W	10013-9	Ref
A4R51	C-3	Res, met flm, 9.53 KΩ 1% 1/4 W	10015-66	2
A4R52	C-3	Res, met flm, 9.53 KΩ 1% 1/4 W	10015-66	Ref
A4R53	B-3	Res, met flm, 4.99 KΩ 1% 1/4 W	10015-65	4
A4R54	B-3	Res, met flm, 6.19 KΩ 1% 1/4 W	10015-105	1
A4R55	B-3	Res, met flm, 4.99 KΩ 1% 1/4 W	10015-65	Ref
A4R56	C-3	Res, met flm, 4.02 KΩ 1% 1/4 W	10015-80	1
A4R57	C-2	Res, car flm, 1 MΩ 5% 1/4 W	10013-61	2
A4R58	C-3	Res, car flm, 470 Ω 5% 1/4 W	10013-21	6
A4R59	B-2	Res, car flm, 1 MΩ 5% 1/4 W	10013-61	Ref
A4R60	B-2	Res, var comp, 100 KΩ 20% 1/4 W	10046-10	Ref
A4R61	B-3	Res, met flm, 1% 1/4 W (Factory Selected Value)		1
A4R62	-	Not Used		
A4R63	C-2	Res, car flm, 4.7 KΩ 5% 1/4 W	10013-33	3
A4R64	-	Not Used		
A4R65	C-2	Res, car flm, 4.7 KΩ 5% 1/4 W	10013-33	Ref
A4R66	D-2	Res, car flm, 100 Ω 5% 1/4 W	10013-13	Ref
A4R67	D-3	Res, car flm, 470 Ω 5% 1/4 W	10013-21	Ref
A4R68	D-3	Res, car flm, 470 Ω 5% 1/4 W	10013-21	Ref
A4R69	E-3	Res, car flm, 22 Ω 5% 1/4 W	10013-5	Ref
A4R70	D-2	Res, car flm, 100 Ω 5% 1/4 W	10013-13	Ref
A4R71	D-3	Res, car flm, 47 Ω 5% 1/4 W	10013-9	Ref
A4R72	D-3	Res, car flm, 470 Ω 5% 1/4 W	10013-21	Ref
A4R73	D-2	Res, car flm, 47 KΩ 5% 1/4 W	10013-45	4
A4R74	D-2	Res, car flm, 15 KΩ 5% 1/4 W	10013-39	1
A4R75	D-3	Res, car flm, 3.3 KΩ 5% 1/4 W	10013-31	Ref
A4R76	D-3	Res, car flm, 3.3 KΩ 5% 1/4 W	10013-31	Ref
A4R77	-	Not Used		
A4R78	-	Not Used		
A4R79	D-2	Res, car flm, 22 KΩ 5% 1/4 W	10013-41	1
A4R80	C-2	Res, met flm, 49.9 KΩ 1% 1/4 W	10015-133	3
A4R81	C-2	Res, met flm, 4.99 KΩ 1% 1/4 W	10015-65	Ref
A4R82	D-2	Res, car flm, 1 KΩ 5% 1/4 W	10013-25	Ref
A4R83	C-2	Res, met flm, 4.99 KΩ 1% 1/4 W	10015-65	Ref
A4R84	C-1	Res, met flm, 14.7 KΩ 1% 1/4 W	10015-10	1
A4R85	C-1	Res, met flm, 17.8 KΩ 1% 1/4 W	10015-9	1
A4R86	D-1	Res, var comp, 2 KΩ 20% 1/4 W	10046-5	1
A4R87	C-1	Res, met flm, 19.6 KΩ 1% 1/4 W	10015-60	1
A4R88	B-1	Res, car flm, 680 Ω 5% 1/4 W	10013-23	1
A4R89	B-1	Res, car flm, 470 Ω 5% 1/4 W	10013-21	Ref
A4R90	C-2	Res, car flm, 3.3 KΩ 5% 1/4 W	10013-31	Ref
A4R91	B-1	Res, car flm, 3.3 KΩ 5% 1/4 W	10013-31	Ref
A4R92	B-1	Res, car flm, 470 Ω 5% 1/4 W	10013-21	Ref
A4R93	B-1	Res, car flm, 2.2 KΩ 5% 1/4 W	10013-29	Ref
A4R94	B-2	Res, car flm, 100 KΩ 5% 1/4 W	10013-49	Ref
A4R95	B-2	Res, car flm, 2.2 KΩ 5% 1/4 W	10013-29	Ref
A4R96	B-1	Res, car flm, 47 KΩ 5% 1/4 W	10013-45	Ref
A4R97	B-1	Res, car flm, 150 KΩ 5% 1/4 W	10013-51	Ref
A4R98	A-1	Res, var comp, 100 KΩ 20% 1/4 W	10046-10	Ref
A4R99	A-1	Res, car flm, 47 KΩ 5% 1/4 W	10013-45	Ref
A4R100	D-1	Res, met flm, 49.9 KΩ 1% 1/4 W	10015-133	Ref
A4R101	C-2	Res, var comp, 1 MΩ 20% 1/4 W	10046-13	Ref
A4R102	D-2	Res, met flm, 499 KΩ 1% 1/4 W	10015-45	2

REPLACEABLE PARTS LIST

REF. DESIG.	LOCATION	DESCRIPTION	GR PART NO.	TOT. QTY.
A4R103	D-1	Res, met flm, 499 KΩ 1% 1/4 W	10015-45	Ref
A4R104	D-2	Res, var comp, 100 KΩ 20% 1/4 W	10046-10	Ref
A4R105	D-1	Res, met flm, 154 KΩ 1% 1/4 W	10015-26	1
A4R106	D-1	Res, var comp, 50 KΩ 20% 1/4 W	10046-3	2
A4R107	D-1	Res, met flm, 215 KΩ 1% 1/4 W	10015-5	Ref
A4R108	D-1	Res, var comp, 50 KΩ 20% 1/4 W	10046-3	Ref
A4R109	D-1	Res, met flm, 191 KΩ 1% 1/4 W	10015-108	1
A4R110	F-1	Res, var comp, 20 KΩ 20% 1/4 W	10046-2	7
A4R111	E-1	Res, met flm, 110 KΩ 1% 1/4 W	10015-54	1
A4R112	F-1	Res, var comp, 20 KΩ 20% 1/4 W	10046-2	Ref
A4R113	E-1	Res, met flm, 100 KΩ 1% 1/4 W	10015-13	1
A4R114	F-2	Res, var comp, 20 KΩ 20% 1/4 W	10046-2	Ref
A4R115	E-2	Res, met flm, 90.9 KΩ 1% 1/4 W	10015-91	1
A4R116	F-2	Res, var comp, 20 KΩ 20% 1/4 W	10046-2	Ref
A4R117	E-2	Res, met flm, 69.8 KΩ 1% 1/4 W	10015-120	1
A4R118	F-2	Res, var comp, 20 KΩ 20% 1/4 W	10046-2	Ref
A4R119	E-2	Res, met flm, 49.9 KΩ 1% 1/4 W	10015-133	Ref
A4R120	F-2	Res, var comp, 10 KΩ 20% 1/4 W	10046-8	Ref
A4R121	F-2	Res, met flm, 39.2 KΩ 1% 1/4 W	10015-61	Ref
A4R122	F-2	Res, var comp, 50 KΩ 20% 1/4 W	10046-3	Ref
A4R123	E-3	Res, met flm, 15 KΩ 1% 1/4 W	10015-87	2
A4R124	F-3	Res, var comp, 50 KΩ 20% 1/4 W	10046-3	Ref
A4R125	F-3	Res, met flm, 15 KΩ 1% 1/4 W	10015-87	Ref
A4R126	F-3	Res, var comp, 20 KΩ 20% 1/4 W	10046-2	2
A4R127	E-2	Res, met flm, 10 KΩ 1% 1/4 W	10015-7	Ref
A4R128	F-3	Res, var comp, 20 KΩ 20% 1/4 W	10046-2	Ref
A4R129	F-3	Res, met flm, 10 KΩ 1% 1/4 W	10015-	Ref
A4R130	E-4	Res, met flm, 169 Ω 1% 1/4 W	10015-155	1
A4R131	E-2	Res, met flm, 806 Ω 1% 1/4 W	10015-154	1
A4R132	E-2	Res, met flm, 39.2 Ω 1% 1/4 W	10015-137	1
A4R133	E-2	Res, met flm, 11.5 Ω 1% 1/4 W	10015-148	1
A4R134	D-2	Res, met flm, 16.9 Ω 1% 1/4 W	10015-149	1
A4R135	E-1	Res, met flm, 27.4 Ω 1% 1/4 W	10015-88	1
A4R136	E-1	Res, met flm, 46.4 Ω 1% 1/4 W	10015-150	1
A4R137	E-1	Res, met flm, 43.2 Ω 1% 1/4 W	10015-128	1
A4R138	E-2	Res, met flm, 59.0 Ω 1% 1/4 W	10015-151	1
A4R139	E-2	Res, met flm, 75.0 Ω 1% 1/4 W	10015-113	1
A4R140	E-2	Res, met flm, 100 Ω 1% 1/4 W	10015-68	1
A4R141	E-2	Res, met flm, 127 Ω 1% 1/4 W	10015-145	1
A4R142	E-3	Res, met flm, 162 Ω 1% 1/4 W	10015-146	1
A4R143	E-3	Res, met flm, 196 Ω 1% 1/4 W	10015-69	1
A4R144	E-3	Res, met flm, 255 Ω 1% 1/4 W	10015-44	1
A4R145	-	Not Used		
A4R146	-	Not Used		
A4R147	C-4	Res, met flm, 287 KΩ 1% 1/4 W	10015-85	1
A4R148	D-5	Res, met flm, 215 KΩ 1% 1/4 W	10015-5	Ref
A4R149	C-5	Res, car flm, 47 KΩ 5% 1/4 W	10013-45	Ref
A4R150	C-5	Res, met flm, 39.2 KΩ 1% 1/4 W	10015-61	Ref
A4R151	C-5	Res, met flm, 143 KΩ 1% 1/4 W	10015-67	1
A4R152	C-5	Res, met flm, 11.3 KΩ 1% 1/4 W	10015-81	1
A4R153	C-5	Res, car flm, 680 KΩ 5% 1/4 W	10013-59	1
A4R154	C-5	Res, met flm, 464 KΩ 1% 1/4 W	10015-6	1
A4R155	C-5	Res, met flm, 38.3 KΩ 1% 1/4 W	10015-8	1
A4R156	C-4	Res, car flm, 1 KΩ 5% 1/4 W	10013-25	Ref
A4R157	C-4	Res, car flm, 1 KΩ 5% 1/4 W	10013-25	Ref
A4R158	B-5	Res, car flm, 100 KΩ 5% 1/4 W	10013-49	Ref

REPLACEABLE PARTS LIST

REF. DESIG.	LOCATION	DESCRIPTION	PART NO.	TOT. QTY.
A4R159	C-4	Res, car flm, 220 KΩ 5% 1/4 W	10013-53	1
A4R160	C-4	Res, var comp, 100 KΩ 20% 1/4 W	10046-10	Ref
A4R161	C-5	Res, car flm, 10 Ω 5% 1/4 W	10013-1	Ref
A4R162	B-5	Res, car flm, 100 KΩ 5% 1/4 W	10013-49	Ref
A4R163	B-4	Res, car flm, 2.2 KΩ 5% 1/4 W	10013-29	Ref
A4R164	B-5	Res, car flm, 4.7 KΩ 5% 1/4 W	10013-33	Ref
A4R165	B-4	Res, car comp, 10 MΩ 5% 1/4 W	10013-73	Ref
A4R166	B-4	Res, car flm, 100 Ω 5% 1/4 W	10013-13	Ref
A4R167	B-4	Res, car comp, 4.7 MΩ 5% 1/4 W	10013-69	2
A4R168	B-5	Res, car flm, 1.5 KΩ 5% 1/4 W	10013-27	Ref
A4R169	B-4	Res, car flm, 100 Ω 5% 1/4 W	10013-13	Ref
A4R170	B-4	Res, car flm, 330 Ω 5% 1/4 W	10013-19	1
A4R171	B-4	Res, car flm, 100 Ω 5% 1/4 W	10013-13	Ref
A4R172	A-5	Res, car comp, 4.7 MΩ 5% 1/4 W	10013-69	Ref
A4R173	A-4	Res, car flm, 220 Ω 5% 1/4 W	10013-17	Ref
A4R174	A-4	Res, car flm, 10 KΩ 5% 1/4 W	10013-37	Ref
A4R175	A-4	Res, car flm, 470 KΩ 5% 1/4 W	10013-57	1
A4RT1	D-5	Thermistor	10209	1
A4S1	E-6	Switch, Pushbutton	12027	1
A4T1	E-3	Transformer, Pulse 4:2:1	11962	1
A4U1	E-4	IC, Op Amp	11539	3
A4U2	F-5	IC, Op Amp	11539	Ref
A4U3	B-6	IC, Op Amp	11539	Ref
A4U4	B-6	IC, Hex Inverter	10722-4	1
A4U5	A-6	IC, Dual 4 Input Gate	10722-2	1
A4U6	E-1	IC, 6 Diode Array	11118	1
A4U7	B-4	IC, Op Amp	10769	1
		Socket, IC, 14 Pin	10978-1	2



SWITCH S1				
POSITION				COUPLER
1	2	3	4	
100uW	1mW	10mW	+10dBm	DIRECT
10mW	100mW	1W	+30dBm	20dB
1W	10W	100W	+20dBW	40dB
100W	1KW	10KW	+10dBkW	60dB

NOTE
UNLESS OTHERWISE SPECIFIED, RESISTOR VALUES ARE IN OHMS AND ARE ±5% 1/4WATT. CAPACITOR VALUES ARE IN MICROFARADS.

LIST OF MATERIAL

NEXT ASSY

DRAWN	YO
ENG	RB
PROD	

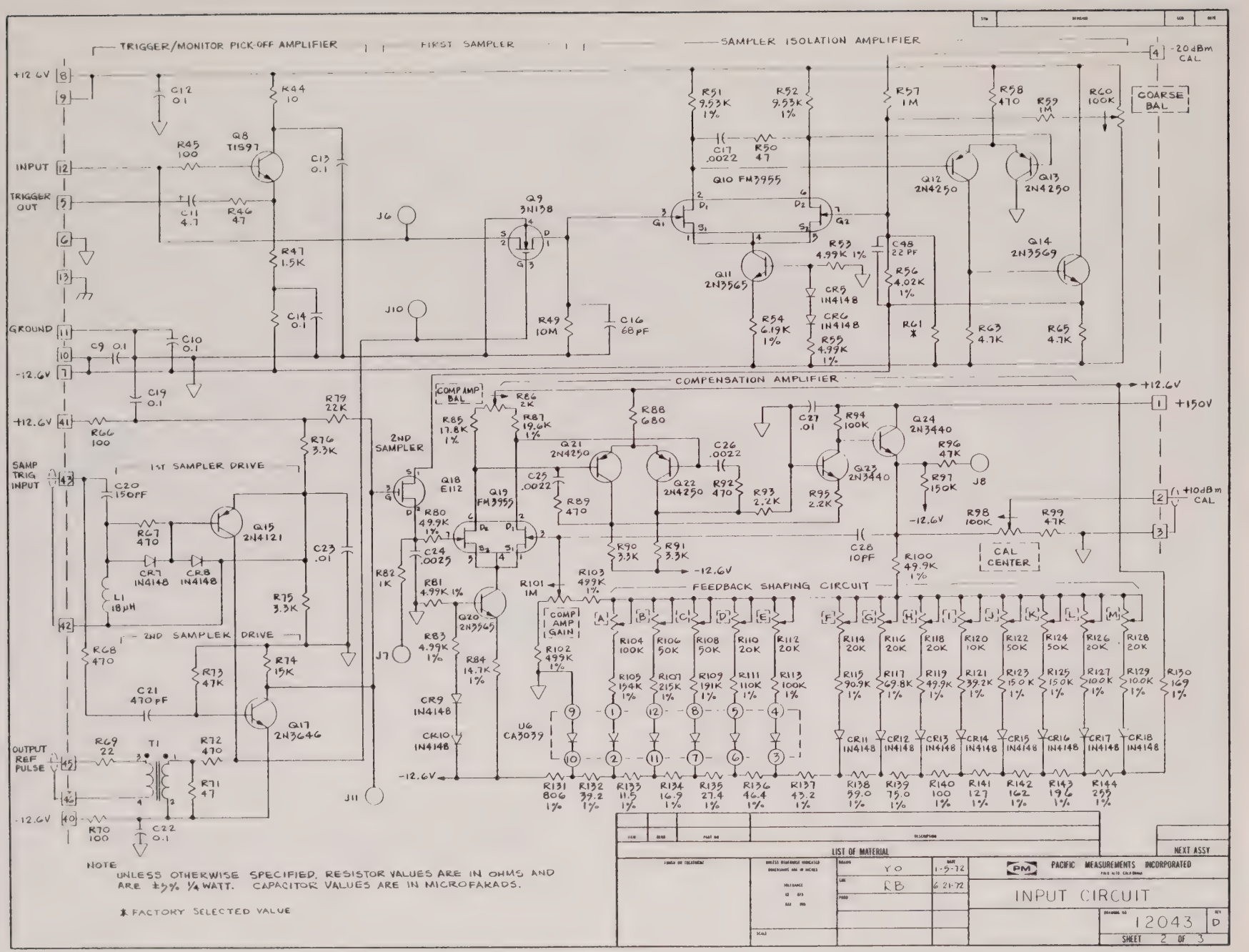
DATE	1-5-72
	6-21-72

PACIFIC MEASUREMENTS INCORPORATED

INPUT CIRCUIT

DRAWING NO 12043 REV A

SHEET 1 OF 3



NOTE

UNLESS OTHERWISE SPECIFIED, RESISTOR VALUES ARE IN OHMS AND ARE ±5% ¼ WATT. CAPACITOR VALUES ARE IN MICROFARADS.

* FACTORY SELECTED VALUE

LIST OF MATERIAL

NEXT ASSY

DRAWN	Y O 1-5-72
CHK	R B 6-21-72

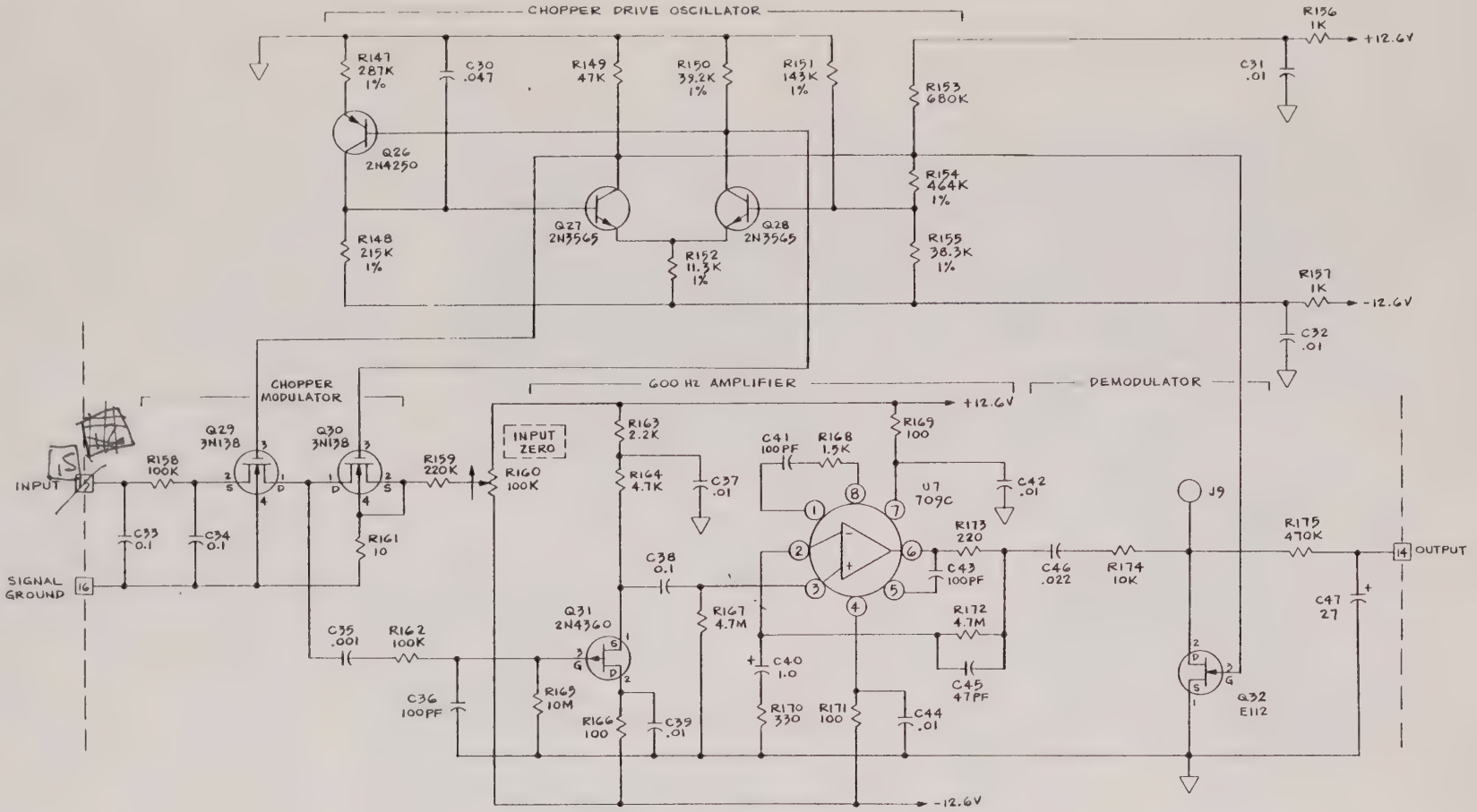
PACIFIC MEASUREMENTS INCORPORATED

INPUT CIRCUIT

DRAWING NO 12043 REV D

SHEET 2 OF 3

ASSEMBLY 12042
REFERENCE DESIGNATOR ARE ABBREVIATED
PREFIX WITH A4



NOTE
UNLESS SPECIFIED OTHERWISE, RESISTOR VALUES ARE IN OHMS AND ARE ±5% ¼ WATT. CAPACITOR VALUES ARE IN MICROFARADS.

LIST OF MATERIAL

NEXT ASSY

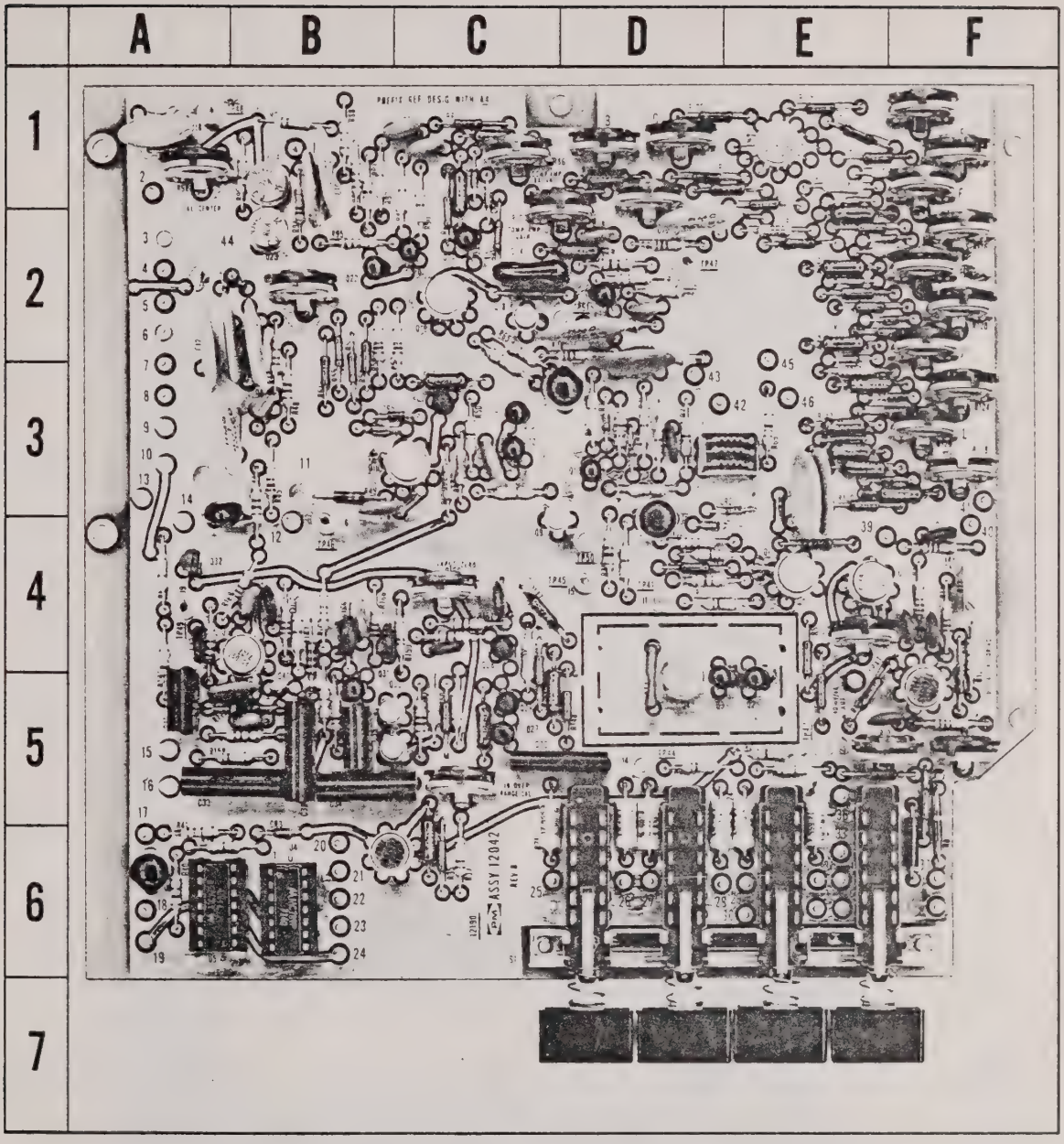
PACIFIC MEASUREMENTS INCORPORATED

DRAWN	YO	1-5-72
ENG	RB	6-21-72

INPUT CIRCUIT

DRAWING NO. 12043 REV A

SHEET 3 OF 3

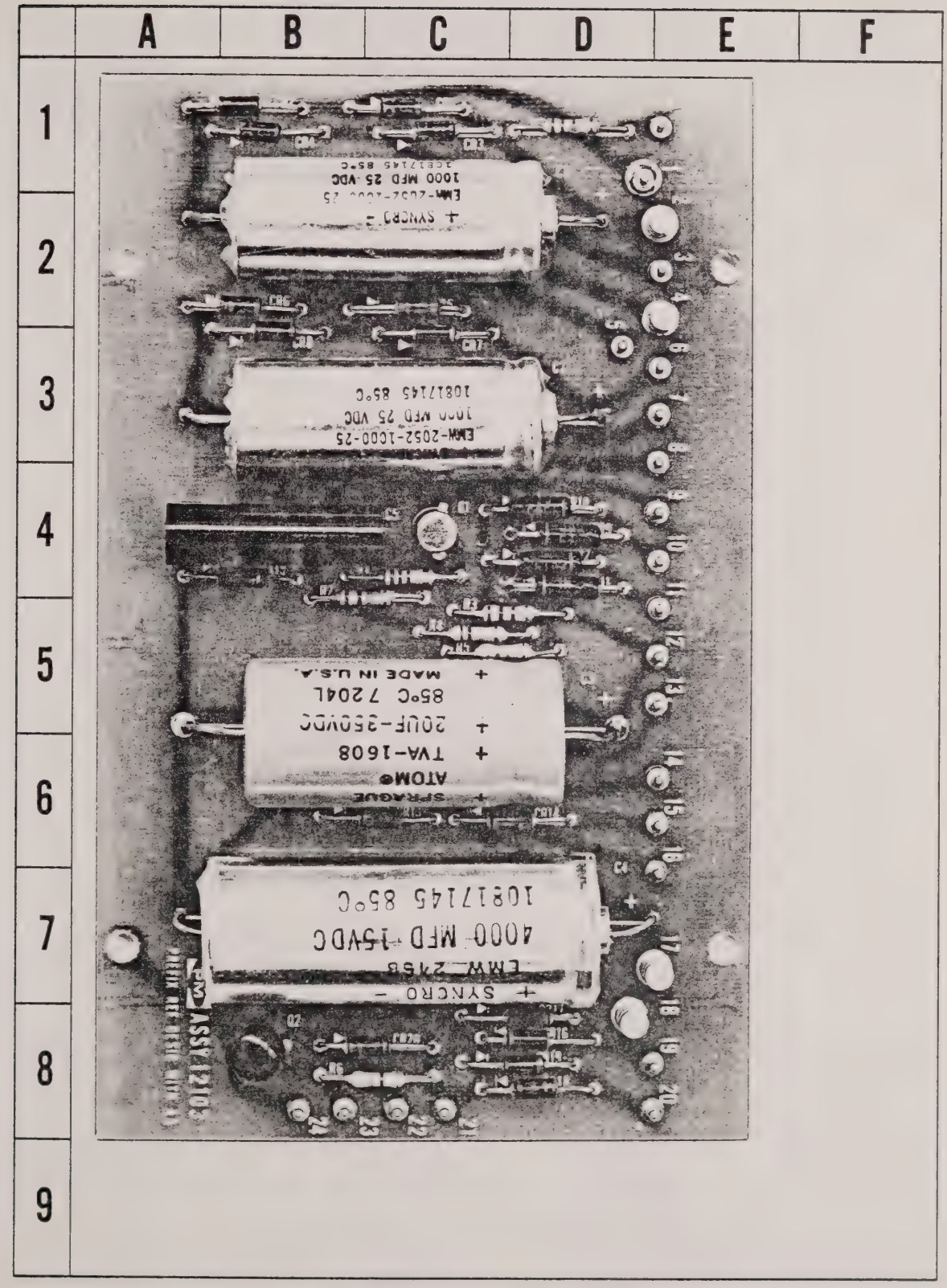


INPUT CIRCUIT BOARD ASSEMBLY
FIGURE 7-6

REPLACEABLE PARTS LIST

REF. DESIG.	LOCATION	DESCRIPTION	PM PART NO.	TOT. QTY.
		RECTIFIER PC BOARD ASSEMBLY - 12103 (Refer to Fig. 7-7)		
A5C1	C-2	Cap, elect, 1000 µF 35 V	10003-7	2
A5C2	C-3	Cap, elect, 1000 µF 35 V	10003-7	Ref
A5C3	C-5	Cap, elect, 20 µF 300 V	10003-4	1
A5C4	C-7	Cap, elect, 4000 µF 15 V	10003-3	1
A5C5	B-4	Cap, mylar, 0.22 µF 10% 200 V	10007-8	1
A5CR1	C-1	Diode, 1N4383	10044-1	15
A5CR2	B-1	Diode, 1N4383	10044-1	Ref
A5CR3	C-1	Diode, 1N4383	10044-1	Ref
A5CR4	B-1	Diode, 1N4383	10044-1	Ref
A5CR5	C-2	Diode, 1N4383	10044-1	Ref
A5CR6	B-2	Diode, 1N4383	10044-1	Ref
A5CR7	C-3	Diode, 1N4383	10044-1	Ref
A5CR8	B-3	Diode, 1N4383	10044-1	Ref
A5CR9	D-4	Diode, 1N4385	10044-2	4
A5CR10	D-4	Diode, 1N4385	10044-2	Ref
A5CR11	D-4	Diode, 1N4385	10044-2	Ref
A5CR12	D-4	Diode, 1N4385	10044-2	Ref
A5CR13	C-6	Diode, 1N4383	10044-1	Ref
A5CR14	D-6	Diode, 1N4383	10044-1	Ref
A5CR15	B-4	Diode, 1N5276B	11434	1
A5CR16	D-8	Diode, 1N4383	10044-1	Ref
A5CR17	D-8	Diode, 1N4383	10044-1	Ref
A5CR18	D-8	Diode, 1N4383	10044-1	Ref
A5CR19	D-8	Diode, 1N4383	10044-1	Ref
A5CR20	C-8	Diode, 1N4383	10044-1	Ref
A5Q1	C-4	Transistor, 2N5833	11692	1
A5Q2	B-8	Transistor, 2N3569	10017	1
A5R1	C-4	Res, car flm, 100 Ω 5% 1/4 W	10013-13	1
A5R2	C-4	Res, car flm, 10 KΩ 5% 1/4 W	10013-37	1
A5R3	C-5	Res, car flm, 1 KΩ 5% 1/4 W	10013-25	1
A5R4	C-5	Res, car flm, 100 KΩ 5% 1/4 W	10013-49	1
A5R5	C-5	Res, car flm, 470 KΩ 5% 1/4 W	10013-57	1
A5R6	C-8	Res, car flm, 470 Ω 5% 1/4 W	10013-21	1
A5R7	D-1	Res, car flm, 220 Ω 5% 1/4 W	10013-17	1

NOTE: See Schematic Diagram 12087 following page 7-6



RECTIFIER CIRCUIT BOARD ASSEMBLY
FIGURE 7-7

REPLACEABLE PARTS LIST

REF. DESIG.	LOCATION	DESCRIPTION	PM PART NO.	TOT. QTY.
		TRIGGER CIRCUIT PC BOARD ASSEMBLY - 12072 (Refer to Fig. 7-8)		
A6C1	A-2	Cap, Ta, 68 µF 20% 15 V	10787-4	1
A6C2	B-2	Cap, cer, 6.8 pF 5% 1000 V	10001-9	1
A6C3	B-2	Cap, cer, 0.1 µF +80%-20% 100 V	10000-10	9
A6C4	B-3	Cap, cer, 470 pF 20% 1000 V	10000-3	1
A6C5	B-3	Cap, Ta, 12 µF 20% 20 V	10787-2	1
A6C6	C-3	Cap, cer, 0.1 µF +80%-20% 100 V	10000-10	Ref
A6C7	C-2	Cap, cer, 0.1 µF +80%-20% 100 V	10000-10	Ref
A6C8	-	Not Used		
A6C9	B-7	Cap, cer, 0.1 µF +80%-20% 100 V	10000-10	Ref
A6C10	C-8	Cap, cer, .001 µF 20% 1000 V	10000-4	3
A6C11	B-8	Cap, cer, 4.7 pF 5% 1000 V	10001-2	1
A6C12	B-8	Cap, cer, 0.1 µF +80%-20% 100 V	10000-10	Ref
A6C13	B07	Cap, cer, 0.1 µF +80%-20% 100 V	10000-10	Ref
A6C14	E-8	Cap, cer, 0.1 µF +80%-20% 100 V	10000-10	Ref
A6C15	D-6	Cap, mylar, .022 µF 10% 200 V	10007-5	2
A6C16	D-5	Cap, mylar, .022 µF 10% 200 V	10007-5	Ref
A6C17	D-2	Cap, Ta, 2.7 µF 20% 15 V	10787-6	1
A6C18	D-2	Cap, cer, .01 µF 20% 100 V	10000-11	4
A6C19	D-7	Cap, cer, .01 µF 20% 1000 V	10000-11	Ref
A6C20	B-7	Cap, cer, .01 µF 20% 100 V	10000-11	Ref
A6C21	E-3	Cap, Ta, 100 µF 20% 15 V	10787-10	2
A6C22	C-2	Cap, cer, 0.1 µF 20% 15 V	10000-10	Ref
A6C23	C-7	Cap, cer, 220 pF 20% 10000 V	10000-2	1
A6C24	E-7	Cap, Ta, 4.7 µF 20% 35 V	10787-1	3
A6C25	E-4	Cap, Ta, 100 µF 20% 20 V	10787-10	Ref
A6C26	D-4	Cap, cer, .001 µF 20% 1000 V	10000-4	Ref
A6C27	D-3	Cap, Ta, 4.7 µF 20% 35 V	10787-1	Ref
A6C28	C-4	Cap, Ta, 4.7 µF 20% 35 V	10787-1	Ref
A6C29	D-4	Cap, cer, .0047 µF 20% 500 V	10000-6	2
A6C30	E-7	Cap, mylar, 0.1 µF 10% 200 V	10007-7	2
A6C31	C-6	Cap, mylar, 0.1 µF 10% 200 V	10007-7	Ref
A6C32	C-5	Cap, cer, 150 pF 20% 1000 V	10000-12	1
A6C33	B-4	Cap, cer, .01 µF 20% 100 V	10000-11	Ref
A6C34	C-4	Cap, mylar, .001 µF 20% 1000 V	10000-4	Ref
A6C35	B-5	Cap, cer, 0.1 µF +80%-20% 100 V	10000-10	Ref
A6C36	D-8	Cap, cer, .0047 µF 20% 500 V	10000-6	Ref
A6CR1	B-8	Diode, 1N4148	10043	15
A6CR2	A-7	Diode, 1N4148	10043	Ref
A6CR3	F-7	Diode, 1N4148	10043	Ref
A6CR4	D-2	Diode, 1N4148	10043	Ref
A6CR5	D-8	Diode, 1N4148	10043	Ref
A6CR6	E-8	Diode, 1N4148	10043	Ref
A6CR7	B-7	Diode, 1N4148	10043	Ref
A6CR8	C-8	Diode, 1N4148	10043	Ref
A6CR9	C-8	Diode, 1N4148	10043	Ref
A6CR10	C-7	Diode, 1N4148	10043	Ref
A6CR11	C-8	Diode, 1N4148	10043	Ref
A6CR12	D-6	Diode, 1N4148	10043	Ref
A6CR13	E-4	Diode, 1N4148	10043	Ref
A6CR14	D-4	Diode, 1N4148	10043	Ref
A6CR15	B-6	Diode, 1N4148	10043	Ref

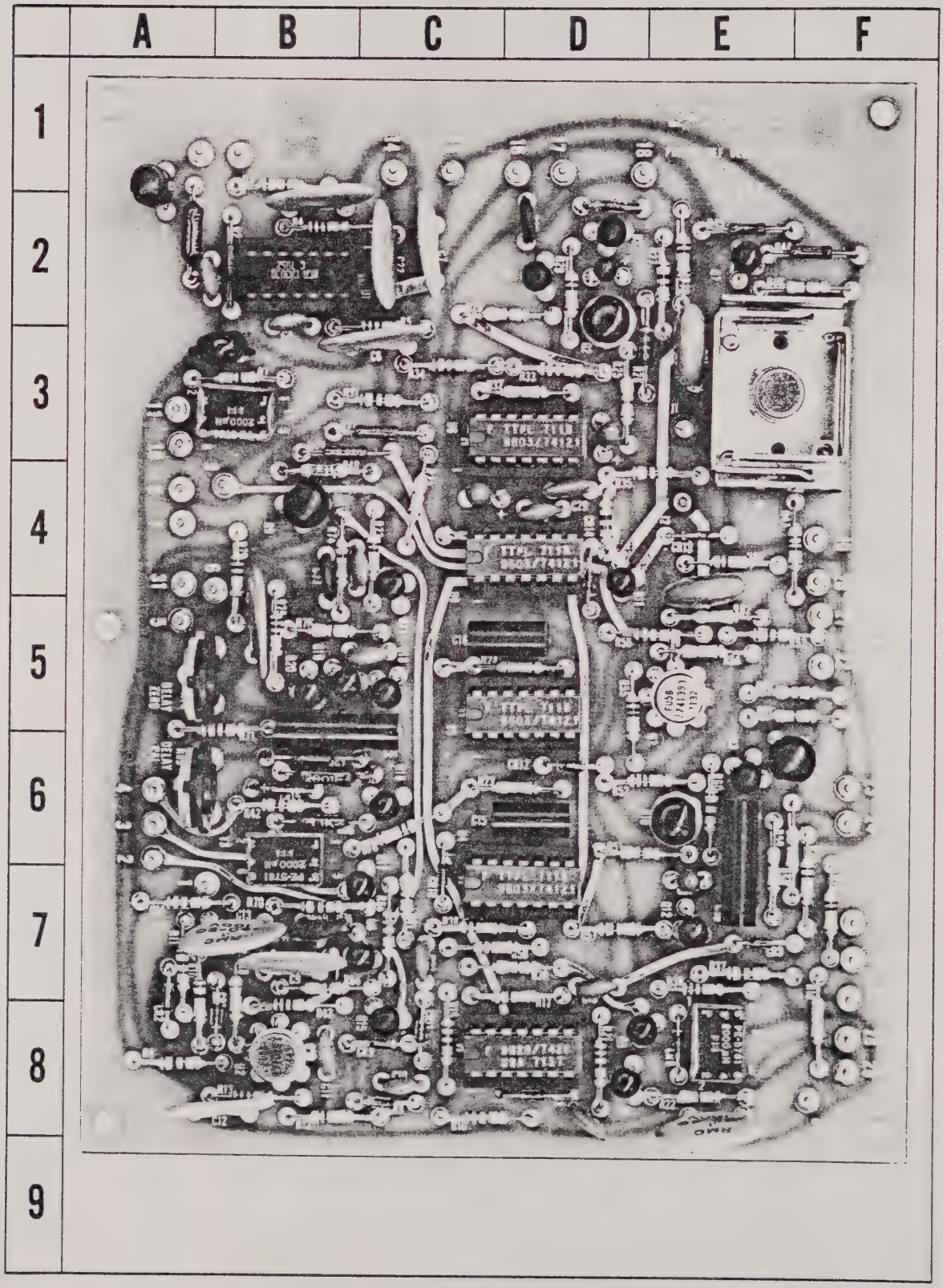
REPLACEABLE PARTS LIST				
REF. DESIG.	LOCA-TION	DESCRIPTION	EM PART NO.	TOT. QTY.
A6J1	E-3	Test Jack, Red	10140-1	1
A6J2	E-4	Test Jack, Black	10140-3	1
A6Q1	D-8	Transistor, 2N3646	10018	7
A6Q2	D-3	Transistor, 2N3569	10017	2
A6Q3	D-2	Transistor, 2N3565	10019	3
A6Q4	D-2	Transistor, 2N3565	10019	Ref
A6Q5	E-8	Transistor, 2N3646	10018	Ref
A6Q6	C-7	Transistor, 2N3646	10018	Ref
A6Q7	E-2	Transistor, 2N4250	11119	4
A6Q8	E-4	Transistor, RCA 40389	11303	1
A6Q9	B-4	Transistor, 2N3644	10023	2
A6Q10	E-6	Transistor, 2N3569	10017	Ref
A6Q11	D-4	Transistor, 2N4250	11119	Ref
A6Q12	E-7	Transistor, 2N3565	10019	Ref
A6Q13	E-6	Transistor, 2N4250	11119	Ref
A6Q14	F-6	Transistor, 2N3644	10023	Ref
A6Q15	C-8	Transistor, 2N4121	10398	2
A6Q16	C-6	Transistor, 2N4250	11119	Ref
A6Q17	C-7	Transistor, 2N3646	10018	Ref
A6Q18	C-5	Transistor, 2N4121	10398	Ref
A6Q19	B-5	Transistor, 2N3646	10018	Ref
A6Q20	B-5	Transistor, 2N3646	10018	Ref
A6Q21	C-5	Transistor, 2N3646	10018	Ref
A6R1	A-2	Res, met flm, 49.9 Ω 1% 1/4 W	10015-3	1
A6R2	B-2	Res, met flm, 1.54 KΩ 1% 1/4 W	10015-1	1
A6R3	B-1	Res, car flm, 680 Ω 5% 1/4 W	10013-23	1
A6R4	B-2	Res, car flm, 100 Ω 5% 1/4 W	10013-13	8
A6R5	C-3	Res, car flm, 100 Ω 5% 1/4 W	10013-13	Ref
A6R6	A-8	Res, car flm, 1 KΩ 5% 1/4 W	10013-25	11
A6R7	B-3	Res, car flm, 47 Ω 5% 1/4 W	10013-9	2
A6R8	B-7	Res, car flm, 68 KΩ 5% 1/4 W	10013-47	2
A6R9	B-7	Res, car flm, 100 Ω 5% 1/4 W	10013-13	Ref
A6R10	B-7	Res, car flm, 10 KΩ 5% 1/4 W	10013-37	3
A6R11	A-7	Res, car flm, 1 KΩ 5% 1/4 W	10013-25	Ref
A6R12	B-8	Res, car flm, 100 KΩ 5% 1/4 W	10013-49	7
A6R13	B-8	Res, car flm, 100 Ω 5% 1/4 W	10013-13	Ref
A6R14	A-7	Res, car flm, 2.2 KΩ 5% 1/4 W	10013-29	8
A6R15	C-8	Res, car flm, 2.2 KΩ 5% 1/4 W	10013-29	Ref
A6R16	C-8	Res, car flm, 2.2KΩ 5% 1/4 W	10013-29	Ref
A6R17	D-7	Res, car flm, 10 KΩ 5% 1/4 W	10013-37	Ref
A6R18	F-7	Res, car flm, 100 KΩ 5% 1/4 W	10013-49	Ref
A6R19	F-8	Res, car flm, 33 KΩ 5% 1/4 W	10013-43	3
A6R20	F-6	Res, car flm, 150 KΩ 5% 1/4 W	10013-51	1
A6R21	D-8	Res, car flm, 2.2 KΩ 5% 1/4 W	10013-29	Ref
A6R22	E-8	Res, car flm, 330 Ω 5% 1/4 W	10013-19	3
A6R23	D-6	Res, car flm, 33 KΩ 5% 1/4 W	10013-43	Ref
A6R24	D-5	Res, car flm, 68 KΩ 5% 1/4 W	10013-47	Ref
A6R25	D-3	Res, car flm, 4.7 KΩ 5% 1/4 W	10013-33	6
A6R26	D-3	Res, car comp, 4.7 MΩ 5% 1/4 W	10013-69	1
A6R27	E-2	Res, car flm, 1 KΩ 5% 1/4 W	10013-25	Ref
A6R28	C-2	Res, car flm, 4.7 KΩ 5% 1/4 W	10013-33	Ref
A6R29	D-2	Res, car flm, 100 KΩ 5% 1/4 W	10013-49	Ref

REPLACEABLE PARTS LIST

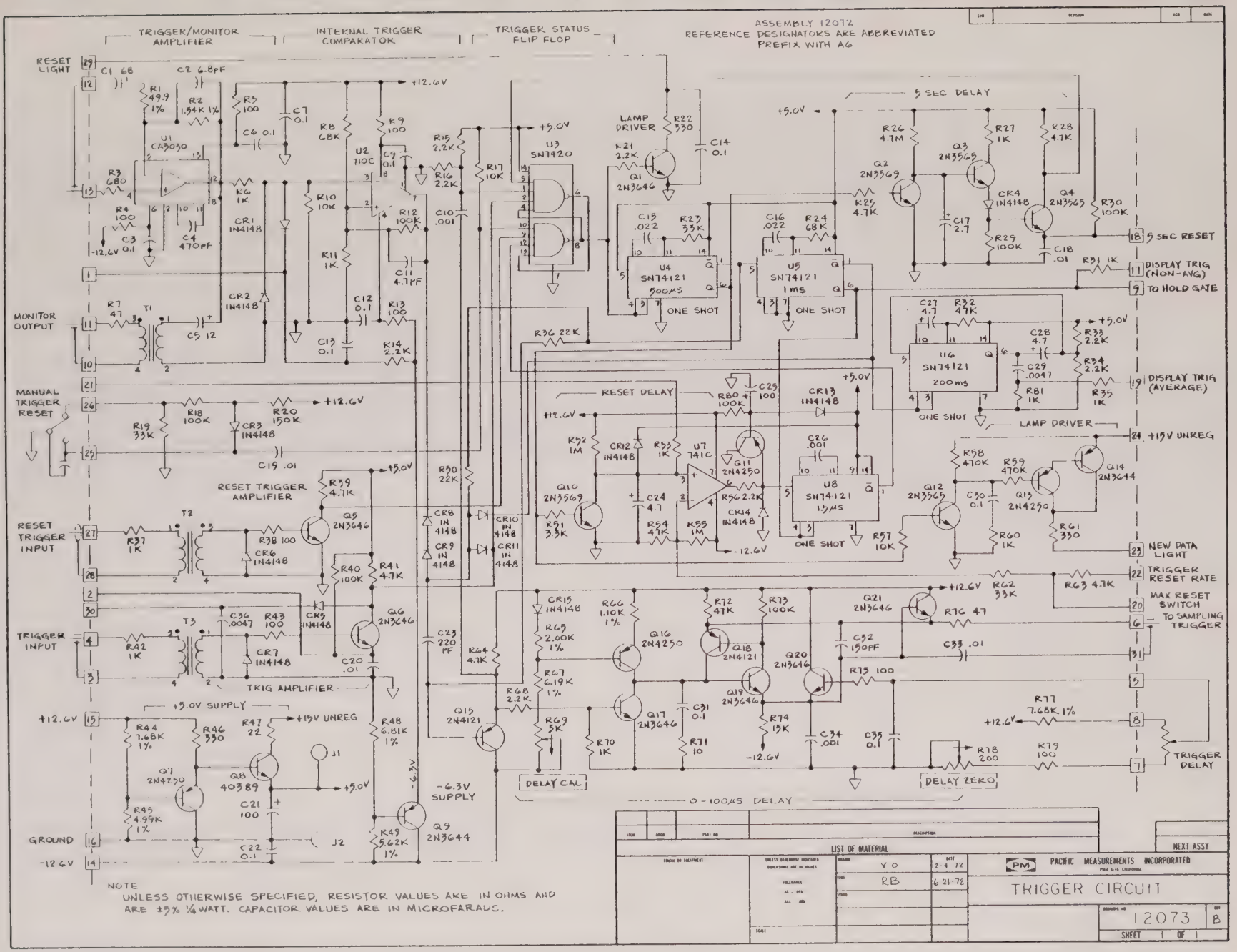
REF. DESIG.	LOCATION	DESCRIPTION	HP PART NO.	TOT. QTY.
A6R30	E-2	Res, car flm, 100 KΩ 5% 1/4 W	10013-49	Ref
A6R31	C-3	Res, car flm, 1 KΩ 5% 1/4 W	10013-25	Ref
A6R32	D-3	Res, car flm, 47 KΩ 5% 1/4 W	10013-45	3
A6R33	D-3	Res, car flm, 2.2 KΩ 5% 1/4 W	10013-29	Ref
A6R34	C-3	Res, car flm, 2.2 KΩ 5% 1/4 W	10013-29	Ref
A6R35	E-4	Res, car flm, 1 KΩ 5% 1/4 W	10013-25	Ref
A6R36	C-7	Res, car flm, 22 KΩ 5% 1/4 W	10013-41	2
A6R37	E-7	Res, car flm, 1 KΩ 5% 1/4 W	10013-25	Ref
A6R38	E-7	Res, car flm, 100 Ω 5% 1/4 W	10013-13	Ref
A6R39	D-7	Res, car flm, 4.7 KΩ 5% 1/4 W	10013-33	Ref
A6R40	C-6	Res, car flm, 100 KΩ 5% 1/4 W	10013-49	Ref
A6R41	C-7	Res, car flm, 4.7 KΩ 5% 1/4 W	10013-33	Ref
A6R42	B-6	Res, car flm, 1 KΩ 5% 1/4 W	10013-25	Ref
A6R43	B-8	Res, car flm, 100 Ω 5% 1/4 W	10013-13	Ref
A6R44	F-2	Res, met flm, 7.68 KΩ 1% 1/4 W	10015-30	2
A6R45	E-2	Res, met flm, 4.99 KΩ 1% 1/4 W	10015-65	1
A6R46	E-2	Res, car flm, 330 Ω 5% 1/4 W	10013-19	Ref
A6R47	F-4	Res, car flm, 22 Ω 5% 1/4 W	10013-5	1
A6R48	B-4	Res, met flm, 6.81 KΩ 1% 1/4 W	10015-106	1
A6R49	B-3	Res, met flm, 5.62 KΩ 1% 1/4 W	10015-104	1
A6R50	D-7	Res, car flm, 22 KΩ 5% 1/4 W	10013-41	Ref
A6R51	E-6	Res, car flm, 3.3 KΩ 5% 1/4 W	10013-31	1
A6R52	E-6	Res, car flm, 1 MΩ 5% 1/4 W	10013-61	2
A6R53	E-5	Res, car flm, 1 KΩ 5 % 1/4 W	10013-25	Ref
A6R54	E-5	Res, car flm, 47 KΩ 5% 1/4 W	10013-45	Ref
A6R55	D-5	Res, car flm, 1 MΩ 5% 1/4 W	10013-61	Ref
A6R56	E-5	Res, car flm, 2.2 KΩ 5% 1/4 W	10013-29	Ref
A6R57	D-7	Res, car flm, 10 KΩ 5% 1/4 W	10013-37	Ref
A6R58	F-6	Res, car flm, 470 KΩ 5% 1/4 W	10013-57	2
A6R59	E-6	Res, car flm, 470 KΩ 5% 1/4 W	10013-57	Ref
A6R60	E-6	Res, car flm, 1 KΩ 5% 1/4 W	10013-25	Ref
A6R61	E-5	Res, car flm, 330 Ω 5% 1/4 W	10013-19	Ref
A6R62	E-5	Res, car flm, 33 KΩ 5% 1/4 W	10013-43	Ref
A6R63	E-5	Res, car flm, 4.7 KΩ 5% 1/4 W	10013-33	Ref
A6R64	B-7	Res, car flm, 4.7 KΩ 5% 1/4 W	10013-33	Ref
A6R65	C-6	Res, met flm, 2.00 KΩ 1% 1/4 W	10015-74	1
A6R66	C-6	Res, met flm, 1.10 KΩ 1% 1/4 W	10015-20	1
A6R67	B-6	Res, met flm, 6.19 KΩ 1% 1/4 W	10015-105	1
A6R68	C-7	Res, car flm, 2.2 KΩ 5% 1/4 W	10013-29	Ref
A6R69	B-6	Res, var comp, 5 KΩ 20% 1/4 W	10046-4	1
A6R70	B-7	Res, car flm, 1 KΩ 5% 1/4 W	10013-25	Ref
A6R71	B-5	Res, car flm, 10 Ω 5% 1/4 W	10013-1	1
A6R72	C-4	Res, car flm, 47 KΩ 5% 1/4 W	10013-45	Ref
A6R73	C-4	Res, car flm, 100 KΩ 5% 1/4 W	10013-49	Ref
A6R74	B-4	Res, car flm, 15 KΩ 5% 1/4 W	10013-39	1
A6R75	B-5	Res, car flm, 100 Ω 5% 1/4 W	10013-13	Ref
A6R76	B-5	Res, car flm, 47 Ω 5% 1/4 W	10013-9	Ref
A6R77	C-3	Res, met flm, 7.68 KΩ 1% 1/4 W	10015-30	Ref
A6R78	B-5	Res, var comp, 200 Ω 20% 1/4 W	10046-6	1
A6R79	B-4	Res, car flm, 100 Ω 5% 1/4 W	10013-13	Ref
A6R80	E-4	Res, car flm, 100 KΩ 5% 1/4 W	10013-49	Ref
A6R81	D-4	Res, car flm, 1 KΩ 5% 1/4 W	10013-25	Ref
A6T1	B-3	Transformer, Pulse PE 5761	12134	3
A6T2	E-8	Transformer, Pulse PE 5761	12134	Ref
A6T3	B-7	Transformer, Pulse PE 5761	12134	Ref

REPLACEABLE PARTS LIST

REF. DESIG.	LOCATION	DESCRIPTION	PART NO.	TOT. QTY.
A6U1	B-2	IC, Op Amp	11116	1
A6U2	B-8	IC, Diff Comparator	11230	1
A6U3	D-8	IC, Dual 4 Input Nand Gate	11270-3	1
A6U4	D-7	IC, Monostable MV	11270-24	4
A6U5	D-5	IC, Monostable MV	11270-24	Ref
A6U6	D-3	IC, Monostable MV	11270-24	Ref
A6U7	E-5	IC, Op Amp	11539	1
A6U8	D-4	IC, Monostable MV	11270-24	Ref
		Socket, IC, 14 Pin	10978-1	6



TRIGGER CIRCUIT BOARD ASSEMBLY
FIGURE 7-8


TRIGGER/MONITOR AMPLIFIER
INTERNAL TRIGGER COMPARATOR
TRIGGER STATUS FLIP FLOP
ASSEMBLY 12072
REFERENCE DESIGNATORS ARE ABBREVIATED PREFIX WITH AG
RESET LIGHT
MONITOR OUTPUT
MANUAL TRIGGER RESET
RESET TRIGGER INPUT
TRIGGER INPUT
GROUND
-12.6V
+12.6V
+5.0V
+15V UNREG
-6.3V
LAMP DRIVER
5 SEC DELAY
ONE SHOT
RESET DELAY
RESET TRIGGER AMPLIFIER
TRIG AMPLIFIER
+5.0V SUPPLY
-6.3V SUPPLY
DELAY CAL
DELAY ZERO
0-100μS DELAY
5 SEC RESET
DISPLAY TRIG (NON-AVG)
TO HOLD GATE
DISPLAY TRIG (AVERAGE)
+15V UNREG
NEW DATA LIGHT
TRIGGER RESET RATE
MAX RESET SWITCH
TO SAMPLING TRIGGER
TRIGGER DELAY
NOTE
UNLESS OTHERWISE SPECIFIED, RESISTOR VALUES ARE IN OHMS AND ARE ±5% ¼ WATT. CAPACITOR VALUES ARE IN MICROFARADS.
LIST OF MATERIAL
NEXT ASSY
PACIFIC MEASUREMENTS INCORPORATED
TRIGGER CIRCUIT
12073
B
SHEET 1 OF 1
Y O
2-4-72
RB
6-21-72

REPLACEABLE PARTS LIST

REF. DESIG.	LOCA-TION	DESCRIPTION	PM PART NO.	TOT. QTY.
		DIGITAL DISPLAY PC BOARD ASSEMBLY - 11354 (Refer to Fig. 7-9)		
A7C1	A-1	Cap, cer, 0.1 µF +80%-20% 100 V	10000-10	3
A7C2	D-3	Cap, cer, 3.3 pF 5% 1000 V	10001-12	1
A7C3	E-3	Cap, cer, 10 pF 5% 1000 V	10001-3	1
A7C4	E-1	Cap, cer, 0.1 µF +80%-20% 100 V	10000-10	Ref
A7C5	A-4	Cap, cer, 0.1 µF +80%-20% 100 V	10000-10	Ref
A7C6	A-2	Cap, Ta, 68 µF 20% 15 V	10787-4	2
A7C7	C-1	Cap, cer, 0.1 µF +80%-20% 100 V	10000-10	Ref
A7C8	D-1	Cap, Ta, 68 µF 20% 15 V	10787-4	Ref
A7C9	A-4	Cap, cer, 220 pF 20% 1000 V	10000-2	3
A7C10	B-4	Cap, cer, .01 µF 20% 500 V	10000-7	1
A7C11	A-4	Cap, cer, 220 pF 20% 1000 V	10000-2	Ref
A7C12	-	Not Used		
A7C13	-	Not Used		
A7C14	F-6	Cap, cer, 0.1 µF +80%-20% 100 V	10000-10	Ref
A7C15	F-6	Cap, cer, 0.1 µF +80%-20% 100 V	10000-10	Ref
A7C16	F-6	Cap, cer, 0.1 µF +80%-20% 100 V	10000-10	Ref
A7C17	A-2	Cap, cer, 0.1 µF +80%-20% 100 V	10000-10	Ref
A7C18	A-4	Cap, cer, 220 pF 20% 1000 V	10000-2	Ref
A7CR1	D-2	Diode, 1N4148	10043	8
A7CR2	D-2	Diode, 1N4148	10043	Ref
A7CR3	D-2	Diode, 1N4148	10043	Ref
A7CR4	E-6	Diode, 1N4148	10043	Ref
A7CR5	E-1	Diode, 1N4148	10043	Ref
A7CR6	E-5	Diode, 1N4148	10043	Ref
A7CR7	A-1	Diode, 1N4148	10043	Ref
A7CR8	A-1	Diode, Zener 1N823	10045	1
A7CR9	-	Not Used		
A7CR10	D-2	Diode, 1N4148	10043	Ref
A7J1	F-1	Test Jack, Yellow	10140-2	5
A7J2	E-1	Test Jack, Yellow	10140-2	Ref
A7J3	A-2	Test Jack, Red	10140-1	2
A7J4	F-1	Test Jack, Red	10140-1	Ref
A7J5	B-2	Test Jack, Yellow	10140-2	Ref
A7J6	B-4	Test Jack, Yellow	10140-2	Ref
A7J7	D-2	Test Jack, Yellow	10140-2	Ref
A7Q1	E-1	Transistor, 2N3644	10023	12
A7Q2	D-1	Transistor, 2N3644	10023	Ref
A7Q3	D-2	Transistor, 2N3646	10018	17
A7Q4	E-6	Transistor, 2N3644	10023	Ref
A7Q5	F-6	Transistor, 2N3644	10023	Ref
A7Q6	E-6	Transistor, 2N3646	10018	Ref
A7Q7	F-2	Transistor, 2N3644	10023	Ref
A7Q8	F-1	Transistor, 2N3644	10023	Ref
A7Q9	E-1	Transistor, 2N3646	10018	Ref
A7Q10	F-5	Transistor, 2N3644	10023	Ref
A7Q11	F-5	Transistor, 2N3644	10023	Ref
A7Q12	E-5	Transistor, 2N3646	10018	Ref

REPLACEABLE PARTS LIST

REF. DESIG.	LOCATION	DESCRIPTION	PM PART NO.	TOT. QTY.
A7Q13	F-2	Transistor, 2N3644	10023	Ref
A7Q14	E-2	Transistor, 2N3646	10018	Ref
A7Q15	F-5	Transistor, 2N3644	10023	Ref
A7Q16	E-5	Transistor, 2N3646	10018	Ref
A7Q17	F-2	Transistor, 2N3644	10023	Ref
A7Q18	E-2	Transistor, 2N3646	10018	Ref
A7Q19	E-4	Transistor, 2N3644	10023	Ref
A7Q20	E-4	Transistor, 2N3646	10018	Ref
A7Q21	F-3	Transistor, 2N4121	10398	7
A7Q22	E-3	Transistor, 2N3646	10018	Ref
A7Q23	F-4	Transistor, 2N4121	10398	Ref
A7Q24	E-4	Transistor, 2N3646	10018	Ref
A7Q25	F-2	Transistor, 2N4121	10398	Ref
A7Q26	E-2	Transistor, 2N3646	10018	Ref
A7Q27	E-3	Transistor, 2N4121	10398	Ref
A7Q28	E-3	Transistor, 2N3646	10018	Ref
A7Q29	F-3	Transistor, 2N4121	10398	Ref
A7Q30	E-3	Transistor, 2N3646	10018	Ref
A7Q31	A-2	Transistor, 2N3569	10017	4
A7Q32	A-2	Transistor, 2N3565	10014	1
A7Q33	C-1	Transistor, 2N2917	10312	1
A7Q34	C-1	Transistor, 2N4121	10398	Ref
A7Q35	C-1	Transistor, 2N4121	10398	Ref
A7Q36	D-1	Transistor, 2N3569	10017	Ref
A7Q37	A-4	Transistor, 2N3646	10018	Ref
A7Q38	A-4	Transistor, 2N3646	10018	Ref
A7Q39	A-4	Transistor, 2N3646	10018	Ref
A7Q40	B-4	Transistor, 2N3646	10018	Ref
A7Q41	B-6	Transistor, 2N3569	10017	Ref
A7Q42	-	Not Used		
A7Q43	-	Not Used		
A7Q44	A-2	Transistor, 2N3569	10017	Ref
A7Q45	A-6	Transistor, 2N5833	11692	3
A7Q46	A-6	Transistor, 2N5833	11692	Ref
A7Q47	B-5	Transistor, 2N5833	11692	Ref
A7QA1	D-2	IC, Dual Buffer	10722-3	1
A7QA2	D-2	IC, Dual J-K Flip Flop	10722-5	10
A7QA3	B-2	IC, Dual J-K Flip Flop	10722-5	Ref
A7QA4	C-2	IC, Dual J-K Flip-Flop	10722-5	Ref
A7QA5	B-3	IC, Triple 3 Input Gate	10722-6	4
A7QA6	B-2	IC, Quad 2 Input Gate	10722-1	3
A7QA7	B-2	IC, Hex Inverter	10722-4	1
A7QA8	C-2	IC, Quad 2 Input Gate	10722-1	Ref
A7QA9	B-3	IC, Dual 4 Input Gate	10722-2	2
A7QA10	B-3	IC, Triple 3 Input Gate	10722-6	Ref
A7QA11	C-3	IC, Triple 3 Input Gate	10722-6	Ref
A7QA12	C-3	IC, Triple 3 Input Gate	10722-6	Ref
A7QA13	D-3	IC, Dual 4 Input Gate	10722-2	Ref
A7QA14	B-4	IC, Dual J-K Flip Flop	10722-5	Ref
A7QA15	C-4	IC, Dual J-K Flip Flop	10722-5	Ref
A7QA16	C-4	IC, Dual J-K Flip Flop	10722-5	Ref
A7QA17	C-4	IC, Dual J-K Flip Flop	10722-5	Ref
A7QA18	D-4	IC, Dual J-K Flip Flop	10722-5	Ref
A7QA19	D-4	IC, Dual J-K Flip Flop	10722-5	Ref

REPLACEABLE PARTS LIST

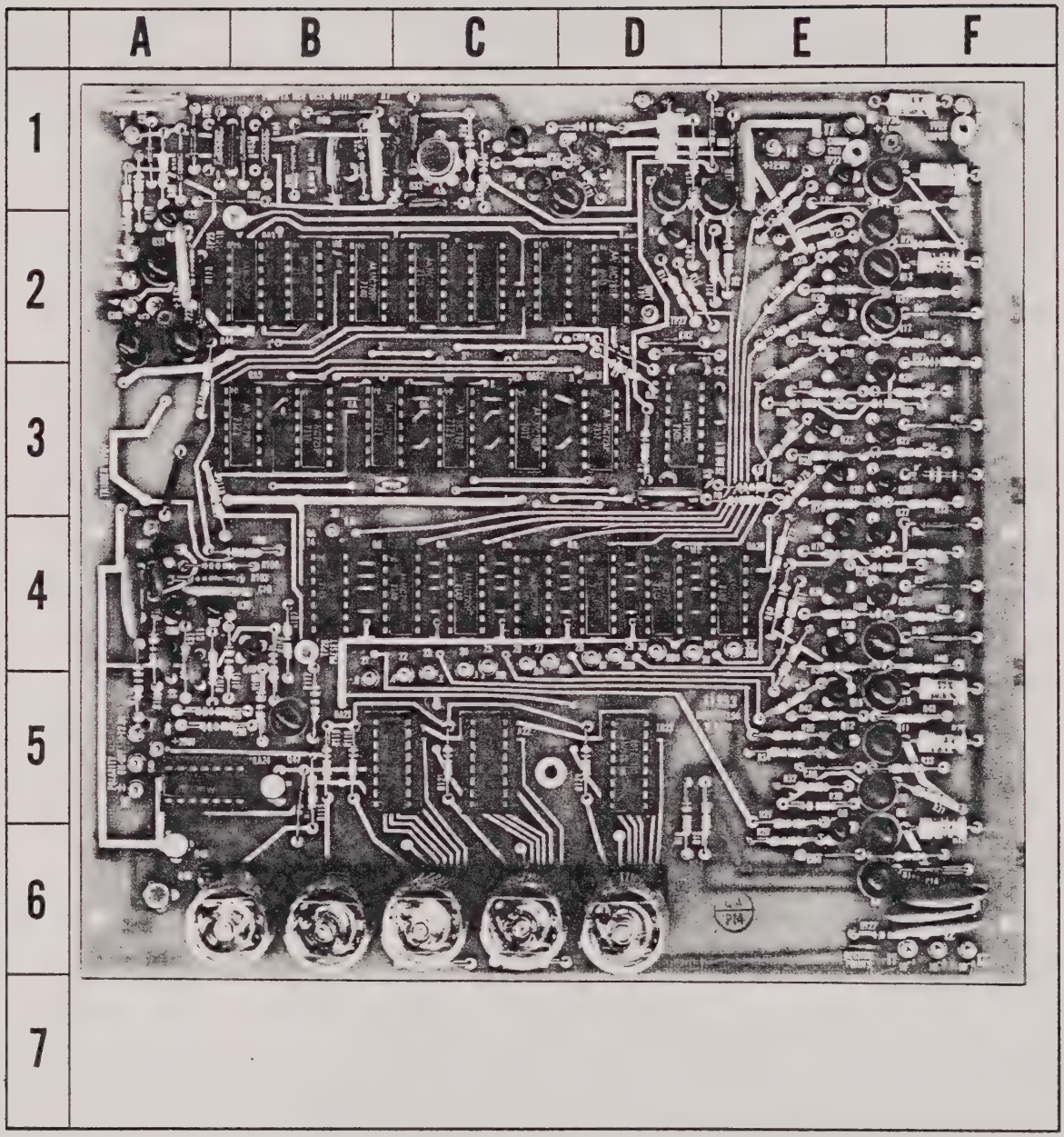
REF. DESIG.	LOCATION	DESCRIPTION	BM PART NO.	TOT. QTY.
A7QA20	E-4	IC, Dual J-K Flip Flop	10722-5	Ref
A7QA21	B-5	IC, Dec Decoder Driver	10728	3
A7QA22	C-5	IC, Dec Decoder Driver	10728	Ref
A7QA23	D-5	IC, Dec Decoder Driver	10728	Ref
A7QA24	A-5	IC, Quad 2 Input Gate	10722-1	Ref
A7QA25	D-3	IC, Op Amp	10743	1
A7R1	D-3	Res, car flm, 6.8 KΩ 5% 1/4 W	10013-35	2
A7R2	D-3	Res, car flm, 100 KΩ 5% 1/4 W	10013-49	5
A7R3	D-3	Res, var comp, 500 Ω 20% 1/4 W	10046-1	1
A7R4	E-3	Res, car flm, 220 Ω 5% 1/4 W	10013-17	3
A7R5	D-1	Res, car comp, 22 MΩ 5% 1/4 W	10142-4	1
A7R6	E-3	Res, car flm, 220 KΩ 5% 1/4 W	10013-53	1
A7R7	F-1	Res, WW, 4.00 KΩ .05% 1/8 W	10725-1	1
A7R8	D-1	Res,WW, .05% 1/8 W (Factory Selected Value)		
A7R9	E-2	Res, car flm, 10 KΩ 5% 1/4 W	10013-37	7
A7R10	E-1	Res, met flm, 8.66 KΩ 1% 1/4 W	10015-57	1
A7R11	E-2	Res, car flm, 47 KΩ 5% 1/4 W	10013-45	6
A7R12	D-1	Res, car flm, 4.7 KΩ 5% 1/4 W	10013-33	27
A7R13	D-2	Res, car flm, 4.7 KΩ 5% 1/4 W	10013-33	Ref
A7R14	D-2	Res, car flm, 470 Ω 5% 1/4 W	10013-21	16
A7R15	F-6	Res, WW, 5.00 KΩ .05% 1/8 W	10725-2	1
A7R16	D-6	Res, car flm, 10 KΩ 5% 1/4 W	10013-37	Ref
A7R17	F-6	Res, met flm, 10.5 KΩ 1% 1/4 W	10015-59	1
A7R18	D-6	Res, car flm, 47 KΩ 5% 1/4 W	10013-45	Ref
A7R19	F-6	Res, car flm, 4.7 KΩ 5% 1/4 W	10013-33	Ref
A7R20	E-6	Res, car flm, 4.7 KΩ 5% 1/4 W	10013-33	Ref
A7R21	E-6	Res, car flm, 470 Ω 5% 1/4 W	10013-21	Ref
A7R22	F-1	Res, WW, 10.0 KΩ 0.1% 1/8 W	10726-1	1
A7R23	E-2	Res, car flm, 10 KΩ 5% 1/4 W	10013-37	Ref
A7R24	F-2	Res, car flm, 22 KΩ 5% 1/4 W	10013-41	5
A7R25	E-2	Res, car flm, 47 KΩ 5% 1/4 W	10013-45	Ref
A7R26	F-2	Res, car flm, 4.7 KΩ 5% 1/4 W	10013-33	Ref
A7R27	E-2	Res, car flm, 4.7 KΩ 5% 1/4 W	10013-33	Ref
A7R28	E-2	Res, car flm, 470 Ω 5% 1/4 W	10013-21	Ref
A7R29	F-5	Res, WW, 20.0 KΩ 0.1% 1/4 W	10726-2	1
A7R30	E-5	Res, car flm, 10 KΩ 5% 1/4 W	10013-37	Ref
A7R31	F-5	Res, car flm, 47 KΩ 5% 1/4 W	10013-45	Ref
A7R32	E-5	Res, car flm, 47 KΩ 5% 1/4 W	10013-45	Ref
A7R33	F-5	Res, car flm, 4.7 KΩ 5% 1/4 W	10013-33	Ref
A7R34	E-5	Res, car flm, 4.7 KΩ 5% 1/4 W	10013-33	Ref
A7R35	E-5	Res, car flm, 470 Ω 5% 1/4 W	10013-21	Ref
A7R36	F-2	Res, WW, 40 KΩ .5% 1/8 W	10727-1	1
A7R37	F-2	Res, car flm, 4.7 KΩ 5% 1/4 W	10013-33	Ref
A7R38	E-2	Res, car flm, 4.7 KΩ 5% 1/4 W	10013-33	Ref
A7R39	E-2	Res, car flm, 470 Ω 5% 1/4 W	10013-21	Ref
A7R40	F-5	Res, WW, 50 KΩ .5% 1/8 W	10727-2	1
A7R41	F-5	Res, car flm, 4.7 KΩ 5% 1/4 W	10013-33	Ref
A7R42	E-5	Res, car flm, 4.7 KΩ 5% 1/4 W	10013-33	Ref
A7R43	E-5	Res, car flm, 470 Ω 5% 1/4 W	10013-21	Ref
A7R44	F-2	Res, met flm, 100 KΩ 1% 1/4 W	10015-13	1
A7R45	F-2	Res, car flm, 4.7 KΩ 5% 1/4 W	10013-33	Ref
A7R46	E-2	Res, car flm, 4.7 KΩ 5% 1/4 W	10013-33	Ref
A7R47	E-2	Res, car flm, 470 Ω 5% 1/4 W	10013-21	Ref
A7R48	F-4	Res, met flm, 200 KΩ 1% 1/4 W	10015-62	1

REPLACEABLE PARTS LIST

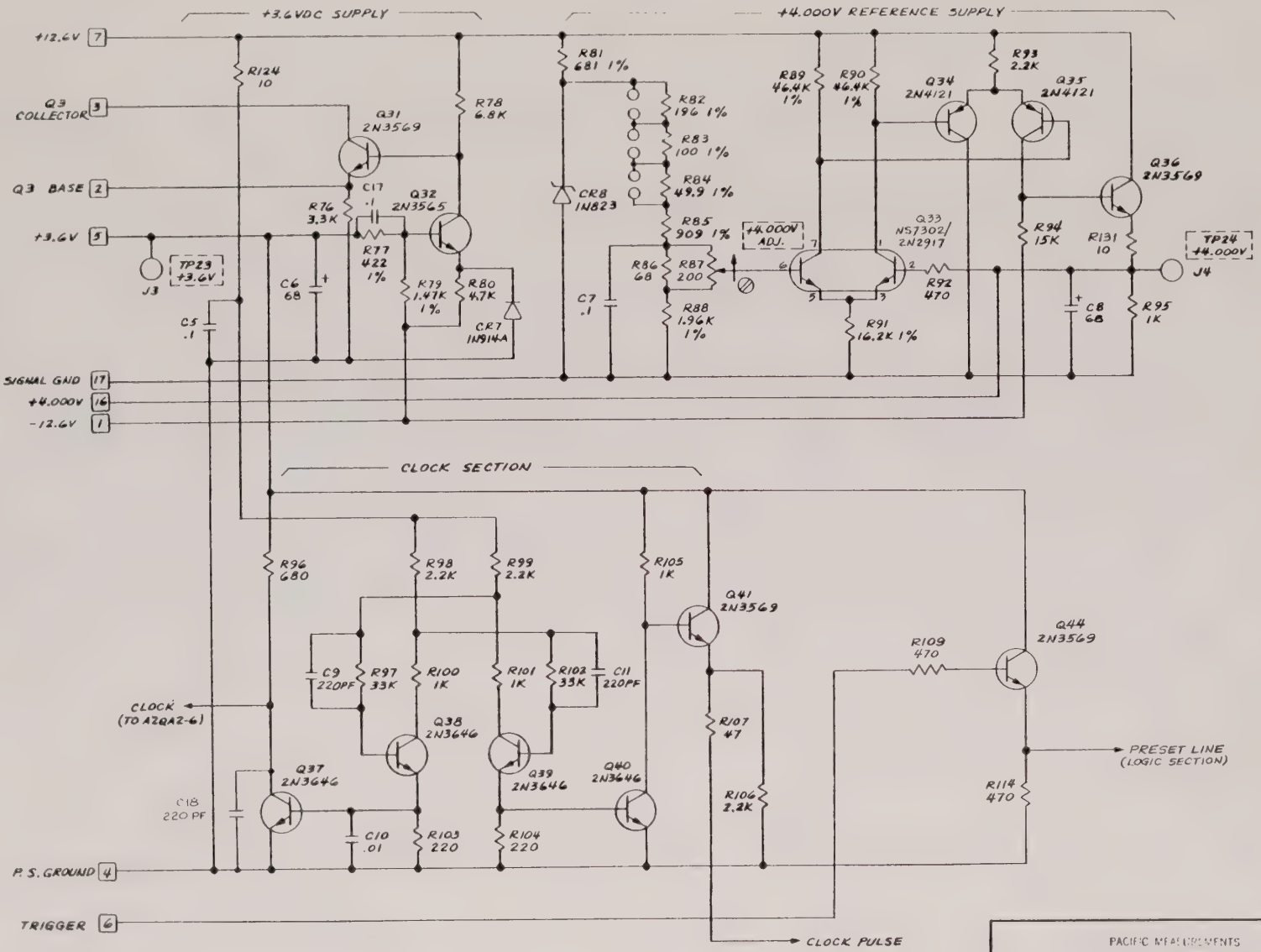
REF. DESIG.	LOCATION	DESCRIPTION	HP PART NO.	TOT. QTY.
A7R49	F-5	Res, car flm, 4.7 KΩ 5% 1/4 W	10013-33	Ref
A7R50	E-5	Res, car flm, 4.7 KΩ 5% 1/4 W	10013-33	Ref
A7R51	E-5	Res, car flm, 470 Ω 5% 1/4 W	10013-21	Ref
A7R52	F-3	Res, met flm, 402 KΩ 1% 1/4 W	10015-63	1
A7R53	F-3	Res, car flm, 100 KΩ 5% 1/4 W	10013-49	Ref
A7R54	F-3	Res, car flm, 4.7 KΩ 5% 1/4 W	10013-33	Ref
A7R55	E-3	Res, car flm, 4.7 KΩ 5% 1/4 W	10013-33	Ref
A7R56	E-3	Res, car flm, 470 Ω 5% 1/4 W	10013-21	Ref
A7R57	F-4	Res, met flm, 499 KΩ 1% 1/4 W	10015-45	1
A7R58	E-4	Res, car flm, 100 KΩ 5% 1/4 W	10013-49	Ref
A7R59	F-4	Res, car flm, 4.7 KΩ 5% 1/4 W	10013-33	Ref
A7R60	E-4	Res, car flm, 4.7 KΩ 5% 1/4 W	10013-33	Ref
A7R61	E-4	Res, car flm, 470 Ω 5% 1/4 W	10013-21	Ref
A7R62	F-3	Res, car flm, 1 MΩ 5% 1/4 W	10013-61	1
A7R63	E-3	Res, car flm, 100 KΩ 5% 1/4 W	10013-49	Ref
A7R64	F-3	Res, car flm, 4.7 KΩ 5% 1/4 W	10013-33	Ref
A7R65	E-3	Res, car flm, 4.7 KΩ 5% 1/4 W	10013-33	Ref
A7R66	E-3	Res, car flm, 470 Ω 5% 1/4 W	10013-21	Ref
A7R67	F-4	Res, car comp, 2 MΩ 5% 1/4 W	10013-74	1
A7R68	E-4	Res, car flm, 100 KΩ 5% 1/4 W	10013-49	Ref
A7R69	F-4	Res, car flm, 4.7 KΩ 5% 1/4 W	10013-33	Ref
A7R70	E-4	Res, car flm, 4.7 KΩ 5% 1/4 W	10013-33	Ref
A7R71	E-4	Res, car flm, 470 Ω 5% 1/4 W	10013-21	Ref
A7R72	F-3	Res, car comp, 3.9 MΩ 5% 1/4 W	10013-68	1
A7R73	F-3	Res, car flm, 4.7 KΩ 5% 1/4 W	10013-33	Ref
A7R74	E-3	Res, car flm, 4.7 KΩ 5% 1/4 W	10013-33	Ref
A7R75	E-3	Res, car flm, 470 Ω 5% 1/4 W	10013-21	Ref
A7R76	A-2	Res, car flm, 3.3 KΩ 5% 1/4 W	10013-31	1
A7R77	A-2	Res, met flm, 422 Ω 1% 1/4 W	10015-29	1
A7R78	A-2	Res, car flm, 6.8 KΩ 5% 1/4 W	10013-35	Ref
A7R79	A-1	Res, met flm, 1.47 KΩ 1% 1/4 W	10015-50	1
A7R80	A01	Res, car flm, 4.7 KΩ 5% 1/4 W	10013-33	Ref
A7R81	B-1	Res, met flm, 681 Ω 1% 1/4 W	10015-70	1
A7R82	B-1	Res, met flm, 196 Ω 1% 1/4 W	10015-69	1
A7R83	B-1	Res, met flm, 100 Ω 1% 1/4 W	10015-68	1
A7R84	B-1	Res, met flm, 49.9 Ω 1% 1/4 W	10015-3	1
A7R85	B-1	Res, met flm, 909 Ω 1% 1/4 W	10015-71	1
A7R86	B-1	Res, car flm, 68 Ω 5% 1/4 W	10013-11	1
A7R87	B-1	Res, var comp, 200 Ω 20% 1/4 W	10046-6	1
A7R88	B-1	Res, met flm, 1.96 KΩ 1% 1/4 W	10015-72	1
A7R89	C-1	Res, met flm, 46.4 KΩ 1% 1/4 W	10015-24	2
A7R90	C-1	Res, met flm, 46.4 KΩ 1% 1/4 W	10015-24	Ref
A7R91	C-1	Res, met flm, 16.2 KΩ 1% 1/4 W	10015-11	1
A7R92	C-1	Res, car flm, 470 Ω 5% 1/4 W	10013-21	Ref
A7R93	C-1	Res, car flm, 2.2 KΩ 5% 1/4 W	10013-29	4
A7R94	C-1	Res, car flm, 15 KΩ 5% 1/4 W	10013-39	1
A7R95	D-1	Res, car flm, 1 KΩ 5% 1/4 W	10013-25	5
A7R96	B-4	Res, car flm, 680 Ω 5% 1/4 W	10013-23	1
A7R97	A-4	Res, car flm, 33 KΩ 5% 1/4 W	10013-43	2
A7R98	A-5	Res, car flm, 2.2 KΩ 5% 1/4 W	10013-29	Ref
A7R99	A-5	Res, car flm, 2.2 KΩ 5% 1/4 W	10013-29	Ref
A7R100	A-5	Res, car flm, 1 KΩ 5% 1/4 W	10013-25	Ref
A7R101	A-5	Res, car flm, 1 KΩ 5% 1/4 W	10013-25	Ref
A7R102	A-5	Res, car flm, 33 KΩ 5% 1/4 W	10013-43	Ref
A7R103	A-4	Res, car flm, 220 Ω 5% 1/4 W	10013-17	Ref
A7R104	A-4	Res, car flm, 220 Ω 5% 1/4 W	10013-17	Ref

REPLACEABLE PARTS LIST

REF. DESIG.	LOCATION	DESCRIPTION	PM PART NO.	TOT. QTY.
A7R105	B-5	Res, car flm, 1 KΩ 5% 1/4 W	10013-25	Ref
A7R106	B-4	Res, car flm, 2.2 KΩ 5% 1/4 W	10013-29	Ref
A7R107	B-4	Res, car flm, 47 Ω 5% 1/4 W	10013-9	1
A7R108	-	Not Used		
A7R109	A-3	Res, car flm, 470 Ω 5% 1/4 W	10013-21	Ref
A7R110	-	Not Used		
A7R111	-	Not Used		
A7R112	-	Not Used		
A7R113	A-2	Buss Wire		
A7R114	A-3	Res, car flm, 470 Ω 5% 1/4 W	10013-21	Ref
A7R115	B-5	Res, car flm, 47 KΩ 5% 1/4 W	10013-45	Ref
A7R116	B-5	Res, car flm, 22 KΩ 5% 1/4 W	10013-41	Ref
A7R117	B-5	Res, car flm, 1 KΩ 5% 1/4 W	10013-25	Ref
A7R118	C-6	Res, car flm, 10 KΩ 5% 1/4 W	10013-37	Ref
A7R119	B-5	Res, car flm, 22 KΩ 5% 1/4 W	10013-41	Ref
A7R120	C-6	Res, car flm, 10 KΩ 5% 1/4 W	10013-37	Ref
A7R121	C-5	Res, car flm, 22 KΩ 5% 1/4 W	10013-41	Ref
A7R122	E-6	Res, car flm, 10 KΩ 5% 1/4 W	10013-37	Ref
A7R123	D-5	Res, car flm, 22 KΩ 5% 1/4 W	10013-41	Ref
A7R124	A-5	Res, car flm, 10 Ω 5% 1/4 W	10013-1	2
A7R125	-	Not Used		
A7R126	B-5	Res, car comp, 10 MΩ 5% 1/4 W	10013-73	1
A7R127	F-6	Res, car comp, 15 MΩ 5% 1/4 W	10142-2	3
A7R128	F-6	Res, car comp, 15 MΩ 5% 1/4 W	10142-2	Ref
A7R129	F-6	Res, car comp, 15 MΩ 5% 1/4 W	10142-2	Ref
A7R130	-	Not Used		
A7R131	D-1	Res, car flm, 10 Ω 5% 1/4 W	10013-1	Ref
A7V1	A-6	Tube, Indicator, Polarity	10724	1
A7V2	B-6	Tube, Indicator, Numerals	10723	4
A7V3	C-6	Tube, Indicator, Numerals	10723	Ref
A7V4	C-6	Tube, Indicator, Numerals	10723	Ref
A7V5	D-6	Tube, Indicator, Numerals	10723	Ref
		Socket, Indicator Tube	10765	5
		Socket, IC, 14 Pin	10978-1	22
		Socket, IC, 16 Pin	10978-2	3



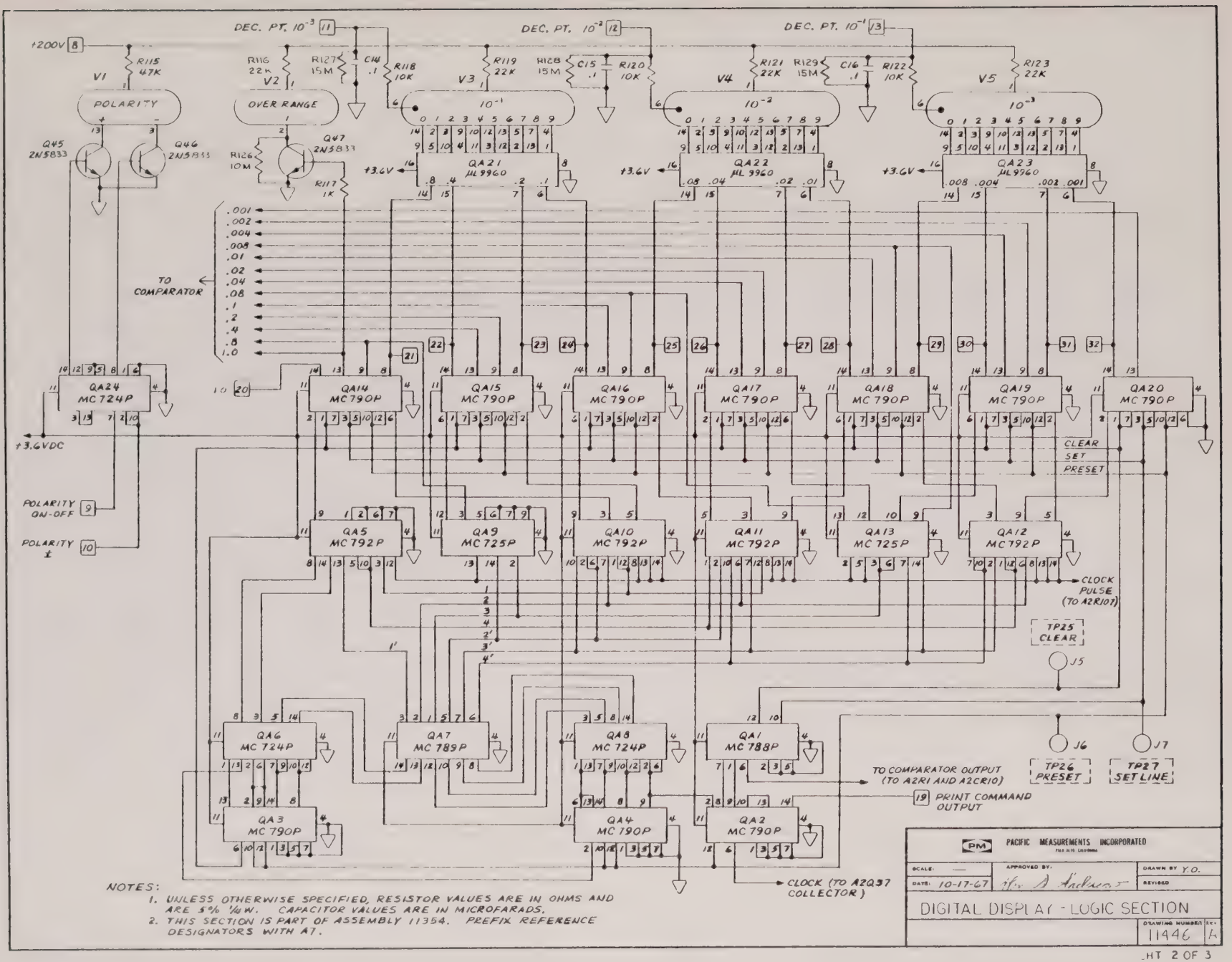
DIGITAL DISPLAY BOARD ASSEMBLY
FIGURE 7-9



NOTES:

1. UNLESS OTHERWISE SPECIFIED, RESISTOR VALUES ARE IN OHMS AND ARE ±5% ¼W. CAPACITOR VALUES ARE IN MICROFARADS.
2. THIS SECTION IS PART OF ASSEMBLY 11354. PREFIX REFERENCE DESIGNATORS WITH A7.

PACIFIC MEASUREMENTS			
SCALE	APPROVED BY: Tom D Sullivan	DRAWN BY Y.O.	
DATE 11-1-67		REVISED	
DIGITAL DISPLAY			
		DRAWING NUMBER 11446	REV. A



NOTES:

1. UNLESS OTHERWISE SPECIFIED, RESISTOR VALUES ARE IN OHMS AND ARE 5% 1/4W. CAPACITOR VALUES ARE IN MICROFARADS.
2. THIS SECTION IS PART OF ASSEMBLY 11354. PREFIX REFERENCE DESIGNATORS WITH A1.

PACIFIC MEASUREMENTS INCORPORATED

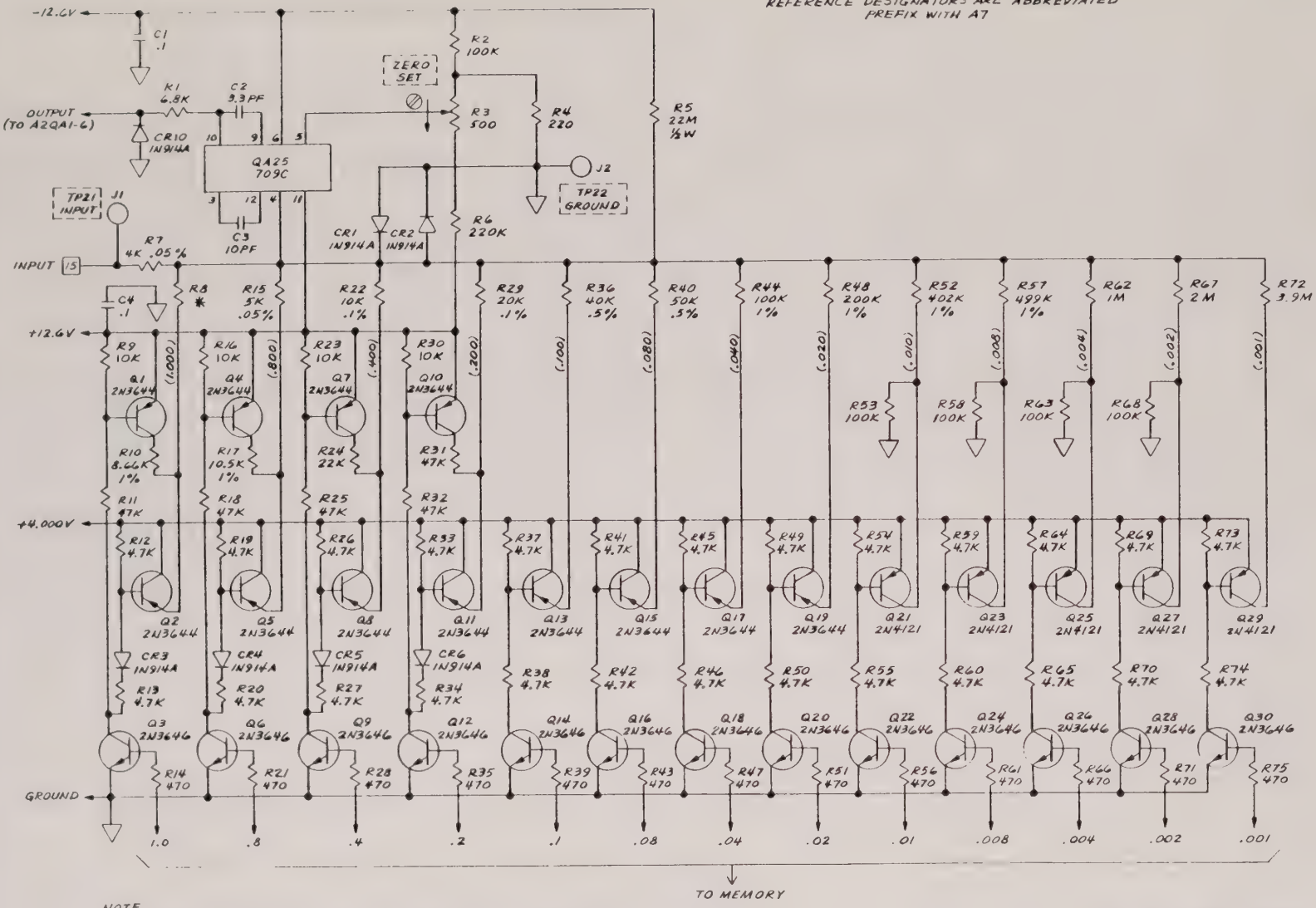
SCALE: —
APPROVED BY:
DRAWN BY Y.O.
DATE: 10-17-67
REVISED

DIGITAL DISPLAY - LOGIC SECTION

DRAWING NUMBER 11446 REV. A

SHT 2 OF 3

ASSEMBLY 11354
REFERENCE DESIGNATORS ARE ABBREVIATED
PREFIX WITH A7



NOTE
1. UNLESS OTHERWISE SPECIFIED, RESISTOR VALUES ARE IN OHMS AND ARE 5% ¼W. CAPACITOR VALUES ARE IN MICROFARADS.
2. * DENOTES FACTORY SELECTED VALUE.

PACIFIC MEASUREMENTS INCORPORATED

SCALE	APPROVED BY:	DRAWN BY Y.O.
DATE 11-17-67		REVISED

DIGITAL DISPLAY - COMPARATOR

DRAWING NUMBER 11446 REV B

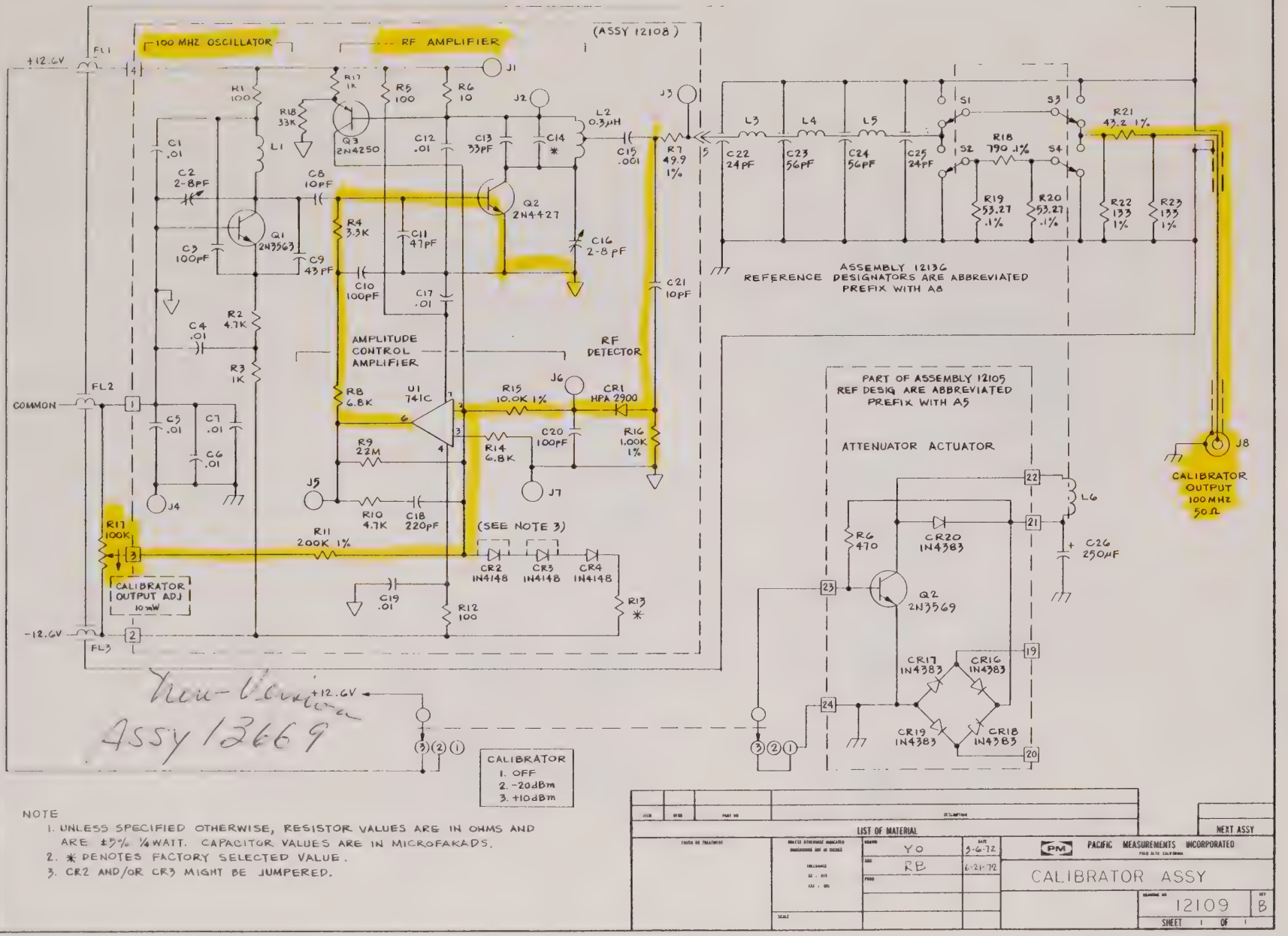
SHT 3 OF 3

REPLACEABLE PARTS LIST

REF. DESIG.	LOCATION	DESCRIPTION	PM PART NO.	TOT. QTY.
		CALIBRATOR OSCILLATOR ASSEMBLY - 12136 (Refer to Figs. 7-10, 7-11 and 7-12)		
A8C22	D-2	Cap, mica, 24 pF 2%	12025-1	2
A8C23	E-2	Cap, mica, 56 pF 2%	12025-2	2
A8C24	E-3	Cap, mica, 56 pF 2%	12025-2	Ref
A8C25	D-3	Cap, mica, 24 pF 2%	12025-1	Ref
A8C26	I-5	Cap, elect, 250 µF 35 V	10003-6	1
A8FL1	A-5	Filter, Feedthru	12024	3
A8FL2	A-6	Filter, Feedthru	12024	Ref
A8FL3	A-6	Filter, Feedthru	12024	Ref
A8J8	*	Connector, Panel Mount Type N	12132	1
A8L3	E-5	Inductor, R.F.	12205	3
A8L4	E-2	Inductor, R.F.	12205	Ref
A8L5	E-6	Inductor, R.F.	12205	Ref
A8L6	I-7	Solenoid	12166	1
A8R17	B-2	Res, var cerm, 100 KΩ 20%	11688-1	1
A8R18	C-2	Res, met flm, 790 Ω 0.1% 1/4 W	11485-17	1
A8R19	*	Res, met flm, 53.27 Ω 0.1% 1/4 W	11485-16	2
A8R20	*	Res, met flm, 53.27 Ω 0.1% 1/4 W	11485-16	Ref
A8R21	B-2	Res, met flm, 43.2 Ω 1% 1/4 W	10015-128	1
A8R22	*	Res, met flm, 133 Ω 1% 1/4 W	10015-139	2
A8R23	*	Res, met flm, 133 Ω 1% 1/4 W	10015-139	Ref
A8S1	C-5	Switch, Snap Action SPDT	11730	4
A8S2	C-5	Switch, Snap Action SPDT	11730	Ref
A8S3	C-5	Switch, Snap Action SPDT	11730	Ref
A8S4	C-5	Switch, Snap Action SPDT	11730	Ref
	*	Not Illustrated		
	J-2	PC Board Assy (Refer to Fig. 7-12)	12108	1
A8C1	P-2	Cap, cer, .01 µF 20% 100 V	10000-11	7
A8C2	P-1	Cap, var cer, 2-8 pF	10630-1	2
A8C3	O-2	Cap, cer, 100 pF 5% 1000 V	10001-7	1
A8C4	P-2	Cap, cer, .01 µF 20% 100 V	10000-11	Ref
A8C5	N-2	Cap, cer, .01 µF 20% 100 V	10000-11	Ref
A8C6	O-4	Cap, cer, .01 µF 20% 100 V	10000-11	Ref
A8C7	O-7	Cap, cer, .01 µF 20% 100 V	10000-11	Ref
A8C8	N-1	Cap, cer, 10 pF 5% 1000 V	10001-3	2
A8C9	O-1	Cap, mica, 43 pF 5% 500 V	10677-16	1
A8C10	O-4	Cap, cer, 100 pF 20% 1000 V	10000-1	2
A8C11	O-2	Cap, cer, 47 pF 5% 1000 V	10001-6	1

REPLACEABLE PARTS LIST

REF. DESIG.	LOCATION	DESCRIPTION	PM PART NO.	TOT. QTY.
A8C12	M-2	Cap, cer, .01 µF 20% 100 V	10000-11	Ref
A8C13	N-2	Cap, erc, 33 pF 5% 1000 V	10001-5	1
A8C14	N-2	Cap, Factory Selected		
A8C15	M-2	Cap, cer, .001 µF 20% 1000 V	10000-4	1
A8C16	N-1	Cap, var cer, 2-8 pF	10630-1	Ref
A8C17	O-5	Cap, cer, 220 pF 20% 1000 V	10000-2	2
A8C18	N-4	Cap, cer, 220 pF 20% 1000 V	10000-2	Ref
A8C19	O-6	Cap, cer, .01 µF 20% 100 V	10000-11	Ref
A8C20	N-4	Cap, cer, 100 pF 20% 1000 V	10000-1	Ref
A8C21	N-3	Cap, Cer, 10 pF 5% 1000 V	10001-3	Ref
A8CR1	M-7	Diode, HPA 2900	11345	1
A8CR2	N-5	Not Used		
A8CR3	N-6	Diode, 1N4148	10043	2
A8CR4	O-6	Diode, 1N4148	10043	Ref
A8J1	M-5	Test Jack, Red	10140-1	1
A8J2	M-3	Test Jack, Yellow	10140-2	5
A8J3	N-3	Test Jack, Yellow	10140-2	Ref
A8J4	N-3	Test Jack, Yellow	10140-2	Ref
A8J5	O-4	Test Jack, Yellow	10140-2	Ref
A8J6	N-5	Test Jack, Yellow	10140-2	Ref
A8J7	N-7	Test Jack, Black	10140-3	1
A8L1	O-1	Inductor	12205	2
A8L2	M-1	Inductor	12205	Ref
A8Q1	O-1	Transistor, 2N3563	10021	1
A8Q2	N-2	Transistor, 2N4427	12159	1
A8Q3	M-5	Transistor, 2N4250	11119	1
A8R1	O-2	Res, car flm, 100 Ω 5% 1/4 W	10013-13	3
A8R2	P-3	Res, car flm, 4.7 KΩ 5% 1/4 W	10013-33	2
A8R3	O-3	Res, car flm, 1 KΩ 5% 1/4 W	10013-25	2
A8R4	O-2	Res, car flm, 3.3 KΩ 5% 1/4 W	10013-31	1
A8R5	O-5	Res, car flm, 100 Ω 5% 1/4 W	10013-13	Ref
A8R6	M-4	Res, car flm, 10 Ω 5% 1/4 W	10013-1	1
A8R7	M-3	Res, met flm, 49.9 Ω 1% 1/4 W	10015-3	1
A8R8	O-3	Res, car flm, 6.8 KΩ 5% 1/4 W	10013-35	2
A8R9	O-4	Res, car comp, 22 MΩ 5% 1/4 W	10142-4	1
A8R10	O-4	Res, car flm, 4.7 KΩ 5% 1/4 W	10013-33	Ref
A8R11	N-5	Res, met flm, 200 KΩ 1% 1/4 W	10015-62	1
A8R12	N-6	Res, car flm, 100 Ω 5% 1/4 W	10013-13	Ref
A8R13	O-6	Res, Factory Selected		
A8R14	N-6	Res, car flm, 6.8 KΩ 5% 1/4 W	10013-35	Ref
A8R15	N-4	Res, met flm, 10.0 KΩ 1% 1/4 W	10015-7	1
A8R16	N-4	Res, met flm, 1.00 KΩ 1% 1/4 W	10015-19	1
A8R17	M-5	Res, car flm, 1 kΩ 5% 1/4 W	10013-25	Ref
A8R18	M-6	Res, car flm, 33 kΩ 5% 1/4W	10013-43	1
A8U1	O-5	IC, SN7274IL Op Amp	11539	1



NOTE

1. UNLESS SPECIFIED OTHERWISE, RESISTOR VALUES ARE IN OHMS AND ARE ±5% ¼WATT. CAPACITOR VALUES ARE IN MICROFAKADS.
2. * DENOTES FACTORY SELECTED VALUE.
3. CR2 AND/OR CR3 MIGHT BE JUMPERED.

LIST OF MATERIAL

NEXT ASSY

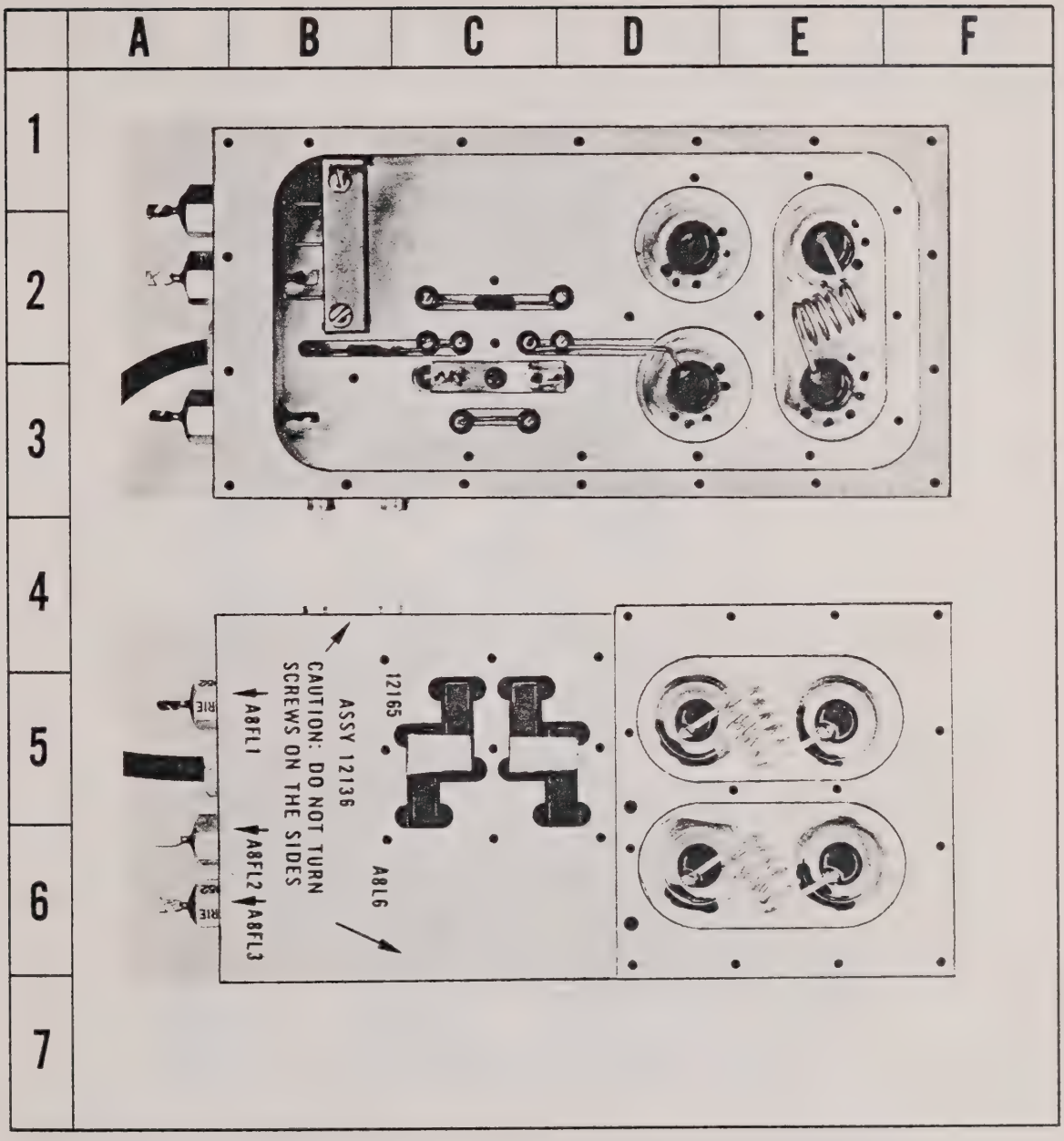
DRAWN	YO	3-6-72
CHK	RB	6-21-72

PACIFIC MEASUREMENTS INCORPORATED

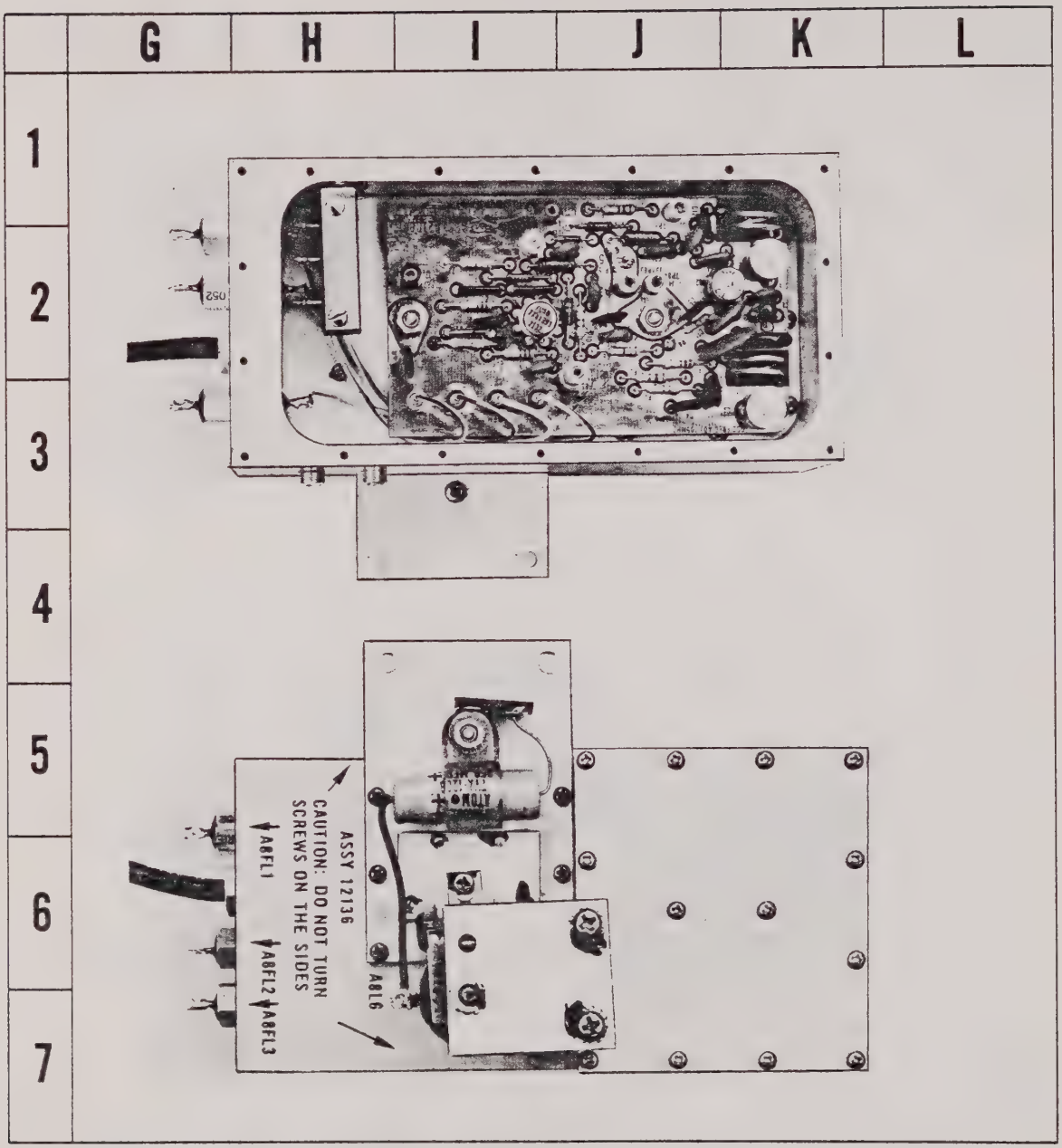
CALIBRATOR ASSY

12109 B

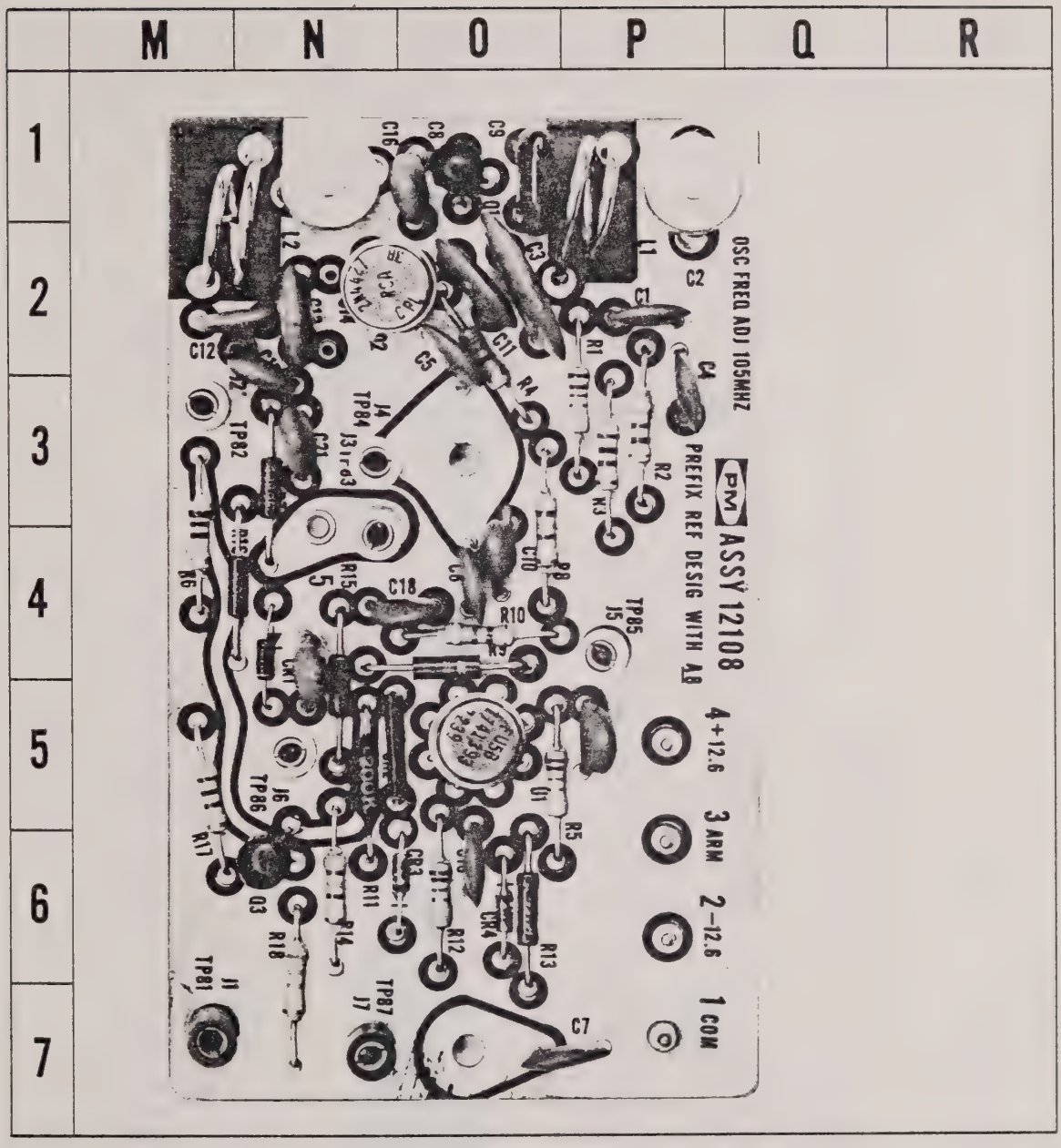
SHEET 1 OF 1



CALIBRATOR OSCILLATOR
FIGURE 7-10



CALIBRATOR OSCILLATOR
FIGURE 7-11

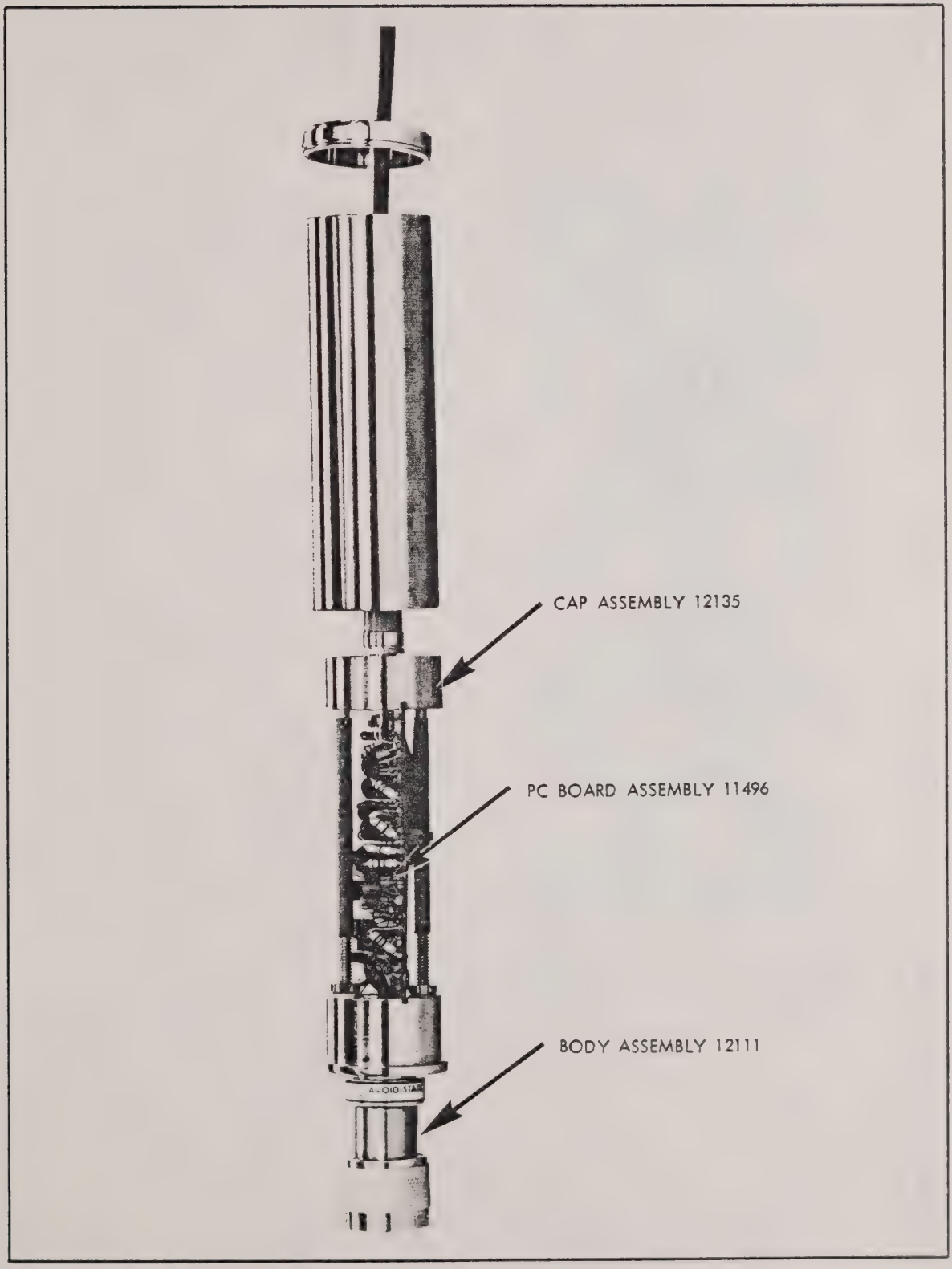


CALIBRATOR OSCILLATOR BOARD ASSEMBLY
FIGURE 7-12

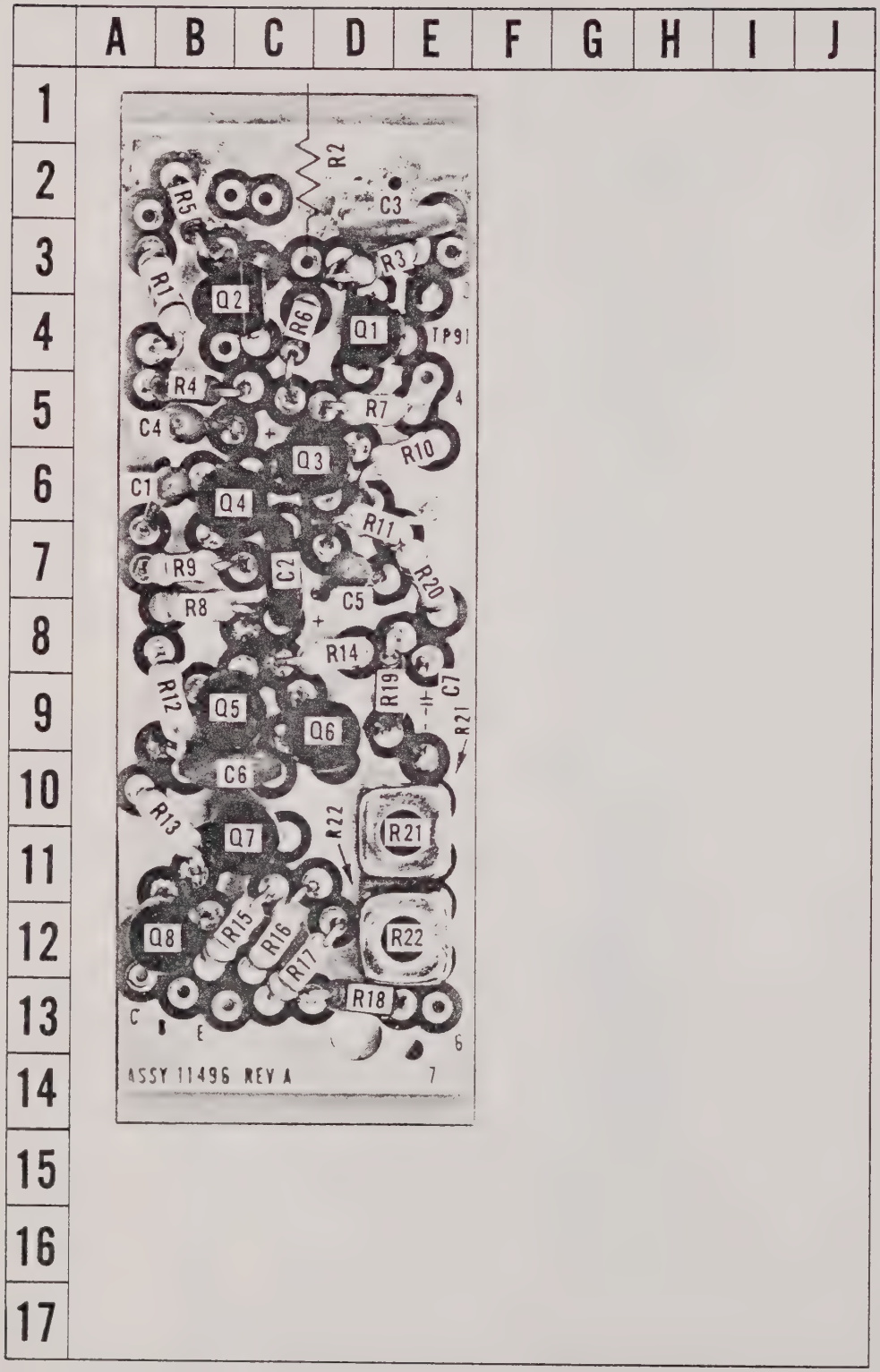
REPLACEABLE PARTS LIST

REF. DESIG.	LOCATION	DESCRIPTION	PM PART NO.	TOT. QTY.
		POWER DETECTOR AMPLIFIER ASSEMBLY - 12125 (Refer to Fig. 7-13)		
		Body Assembly	12111	
A9CR1	*	Diode Replacement Kit (Part of Body Assy 12111)	11508	
		Cap Assembly	12135	
A9R23	*	Res, met flm, 50Ω (Part of Cap Assy 12135)	~~11207~~ 12007	
		PULSE AMPLIFIER PC BOARD ASSEMBLY - 11496 ✓ (Refer to Fig. 7-14)		
A9C1	B-6	Cap, Ta, .47 µF 20% 35 V	10787-8	3
A9C2	C-8	Cap, cer, .01 µF 20% 100 V	10000-11	1
A9C3	D-3	Cap, cer, .0047 µF 20% 500 V	10000-6	1
A9C4	B-5	Cap, Ta, .47 µF 20% 35 V	10787-8	Ref
A9C5	D-7	Cap, Ta, .47 µF 20% 35 V	10787-8	Ref
A9C6	B-10	Cap, cer, 470 pF 20% 1000 V	10000-3	1
A9C7	E-9	Cap, cer, 1.0 pF ±.25 pF 500 V	10133-3	1
A9C8	*	Cap, cer, 10 pF 5% 1000 V	10001-3	1
A9L1	*	Shield Bead	10182	1
A9Q1	D-4	Transistor, 2N5245	**12163-2	1
A9Q2	B-4	Transistor, 2N5245	**12163-2	Ref
A9Q3	D-6	Transistor, 2N4121	10398	2
A9Q4	B-6	Transistor, 2N4121	10398	Ref
A9Q5	B-9	Transistor, 2N3563 B>45	10681	2
A9Q6	D-10	Transistor, 2N3563 B>45	10681	Ref
A9Q7	B-11	Transistor, 2N3563	10021	2
A9Q8	B-12	Transistor, 2N3563	10021	Ref
A9Q9	*	Transistor, 2N3646	10018	1
A9R1	B-4	Res, car flm, 10 Ω 5% 1/4 W	10013-1	2
A9R2	C-2	Res, met flm, 4.99 KΩ 1% 1/8 W	11518-1	1
A9R3	D-3	Res, car flm, 22 KΩ 5% 1/4 W	10013-41	1
A9R4	B-5	Res, met flm, 825 Ω 1% 1/4 W	10015-132	2
A9R5	B-3	Res, met flm, 825 Ω 1% 1/4 W	10015-132	Ref
A9R6	C-4	Res, met flm, 2.26 KΩ 1% 1/4 W	10015-78	1
A9R7	D-5	Res, car flm, 10 Ω 5% 1/4 W	10013-1	Ref
A9R8	B-8	Res, car flm, 5% 1/4W Factory Selected Value		1
A9R9	B-7	Res, car flm, 1 KΩ 5% 1/4 W	10013-25	1
A9R10	E-6	Res, car flm, 6.8 KΩ 5% 1/4 W	10013-35	2
A9R11	D-7	Res, car flm, 6.8 KΩ 5% 1/4 W	10013-35	Ref
A9R12	B-9	Res, car flm, 5% 1/4 W Factory Selected Value		1
A9R13	B-11	Res, car flm, 1.5 KΩ 5% 1/4 W	10013-27	3
A9R14	D-9	Res, car flm, 470 Ω 5% 1/4 W	10013-21	1
A9R15	C-12	Res, car flm, 2.2 KΩ 5% 1/4 W	10013-29	1
A9R16	D-12	Res, car flm, 1.5 KΩ 5% 1/4 W	10013-27	Ref
A9R17	D-13	Res, car flm, 1.5 KΩ 5% 1/4 W	10013-27	Ref
A9R18	D-13	Res, met flm, 49.9 Ω 1% 1/4 W	10015-3	1
A9R19	E-9	Res, met flm, 17.8 KΩ 1% 1/4 W	10015-9	1
A9R20	E-8	Res, car flm, 100 Ω 5% 1/4 W	10013-13	1
A9R21	E-11	Res, var cerm, 1 KΩ 20% 1/2 W	11499-1	2
A9R22	E-12	Res, var cerm, 1 KΩ 20% 1/2 W	11499-1	Ref

*Not illustrated ** Matched pair

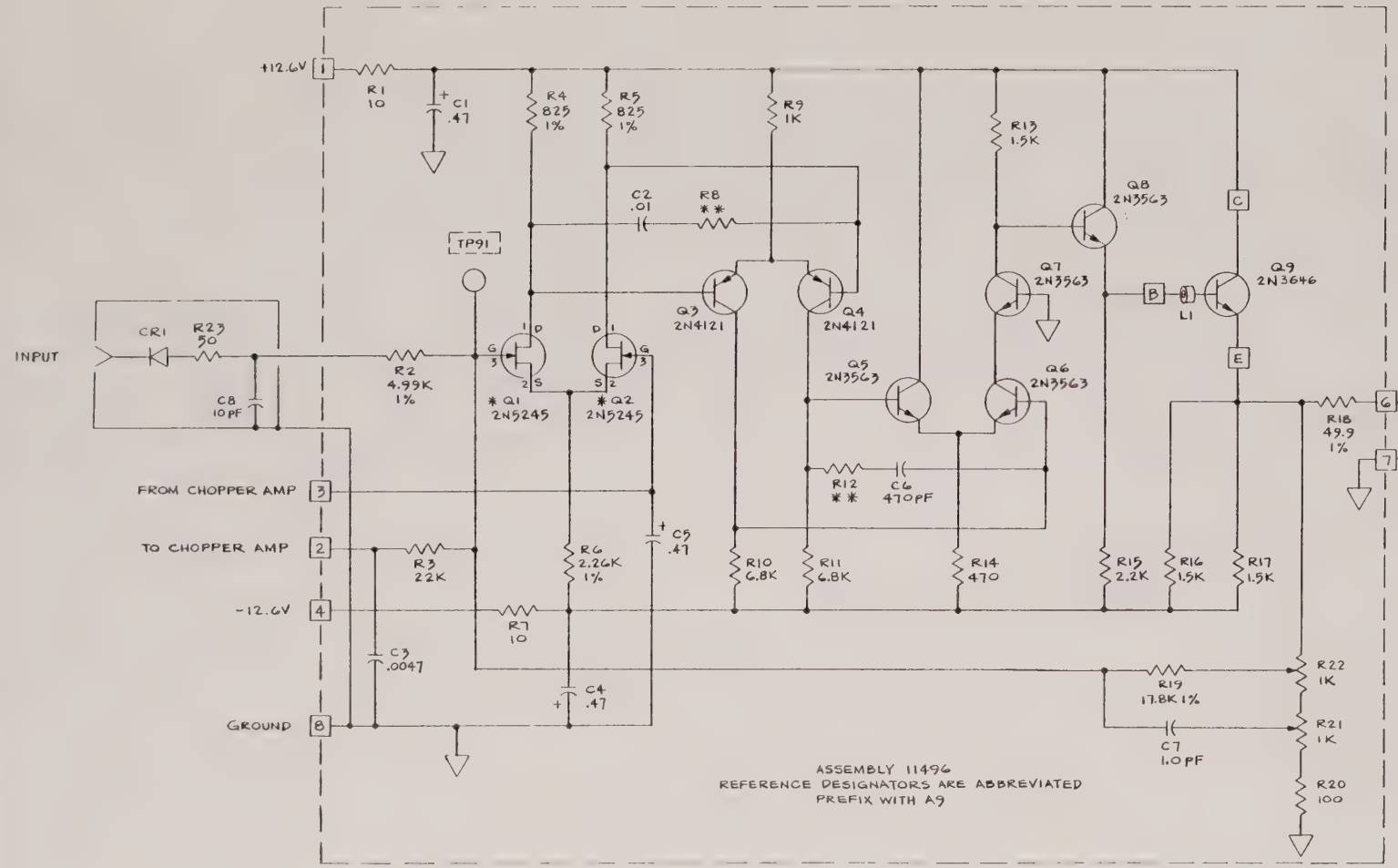


POWER DETECTOR AMPLIFIER
FIGURE 7-13



PULSE AMPLIFIER BOARD ASSEMBLY
FIGURE 7-14

ASSEMBLY 12125
REFERENCE DESIGNATORS ARE ABBREVIATED
PREFIX WITH A9



ASSEMBLY 11496
REFERENCE DESIGNATORS ARE ABBREVIATED
PREFIX WITH A9

NOTE:

1. UNLESS SPECIFIED OTHERWISE, RESISTOR VALUES ARE IN OHMS AND ARE ±5% 1/4 WATT. CAPACITOR VALUES ARE IN MICROFARADS.
2. * DENOTES MATCHED PAIR.
3. ** DENOTES FACTORY SELECTED VALUES

LIST OF MATERIAL

NEXT ASSY

DRAWN	Y O 2-3-72
CHK	R B 6-21-72

PACIFIC MEASUREMENTS INCORPORATED

DETECTOR AMPLIFIER

11497 C

SHEET 1 OF 1

REPLACEABLE PARTS LIST

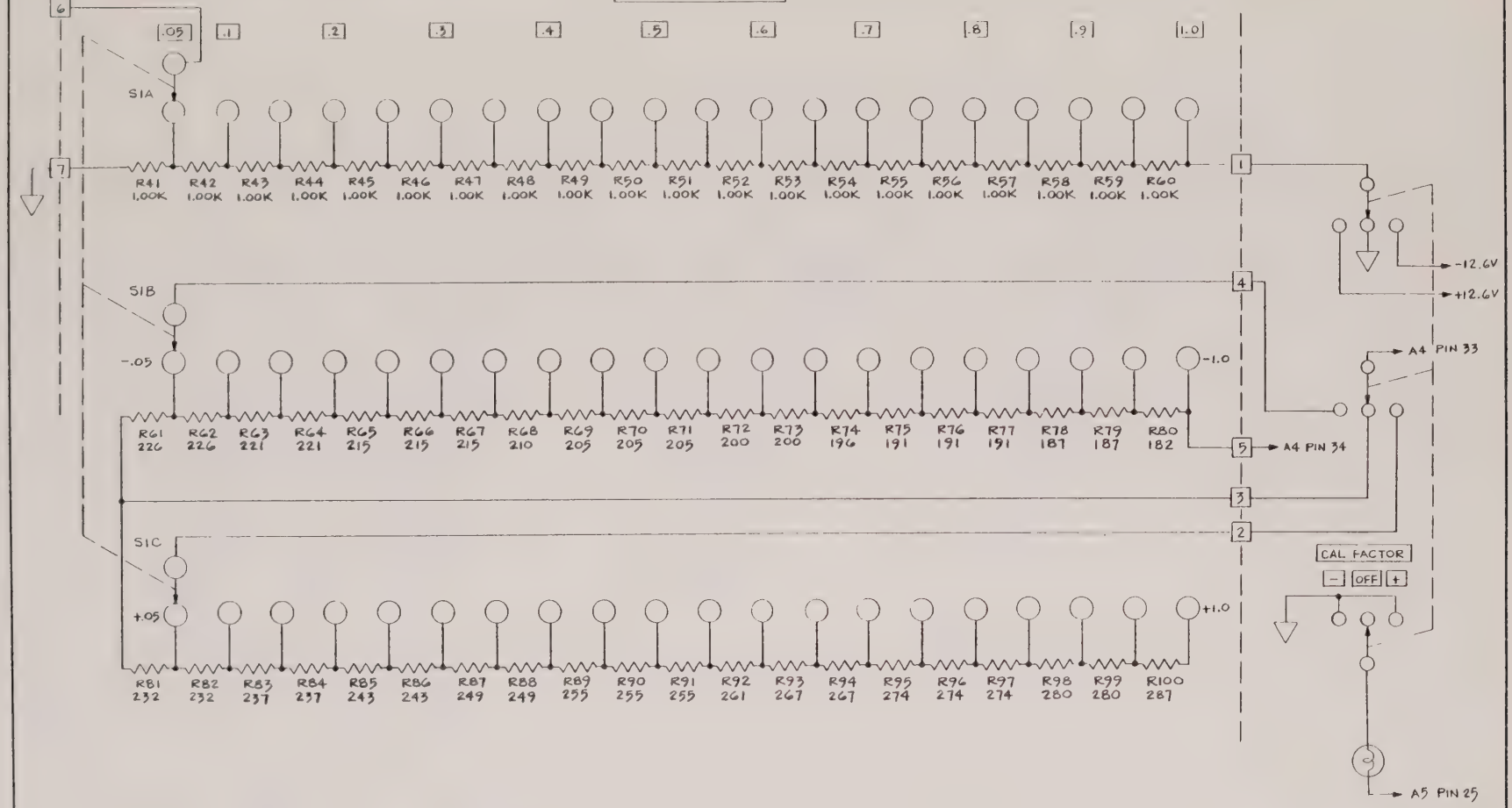
REF. DESIG.	LOCATION	DESCRIPTION	HP PART NO.	TOT. QTY.
		CAL FACTOR SWITCH ASSEMBLY - 12088 (Refer to Fig. 7-15)		
A10R41		Res, met flm, 1.00 KΩ 1% 1/4 W	10015-19	20
A10R42		Res, met flm, 1.00 KΩ 1% 1/4 W	10015-19	Ref
A10R43		Res, met flm, 1.00 KΩ 1% 1/4 W	10015-19	Ref
A10R44		Res, met flm, 1.00 KΩ 1% 1/4 W	10015-19	Ref
A10R45		Res, met flm, 1.00 KΩ 1% 1/4 W	10015-19	Ref
A10R46		Res, met flm, 1.00 KΩ 1% 1/4 W	10015-19	Ref
A10R47		Res, met flm, 1.00 KΩ 1% 1/4 W	10015-19	Ref
A10R48		Res, met flm, 1.00 KΩ 1% 1/4 W	10015-19	Ref
A10R49		Res, met flm, 1.00 KΩ 1% 1/4 W	10015-19	Ref
A10R50		Res, met flm, 1.00 KΩ 1% 1/4 W	10015-19	Ref
A10R51		Res, met flm, 1.00 KΩ 1% 1/4 W	10015-19	Ref
A10R52		Res, met flm, 1.00 KΩ 1% 1/4 W	10015-19	Ref
A10R53		Res, met flm, 1.00 KΩ 1% 1/4 W	10015-19	Ref
A10R54		Res, met flm, 1.00 KΩ 1% 1/4 W	10015-19	Ref
A10R55		Res, met flm, 1.00 KΩ 1% 1/4 W	10015-19	Ref
A10R56		Res, met flm, 1.00 KΩ 1% 1/4 W	10015-19	Ref
A10R57		Res, met flm, 1.00 KΩ 1% 1/4 W	10015-19	Ref
A10R58		Res, met flm, 1.00 KΩ 1% 1/4 W	10015-19	Ref
A10R59		Res, met flm, 1.00 KΩ 1% 1/4 W	10015-19	Ref
A10R60		Res, met flm, 1.00 KΩ 1% 1/4 W	10015-19	Ref
A10R61		Res, met flm, 226 Ω 1% 1/4 W	10015-147	2
A10R62		Res, met flm, 226 Ω 1% 1/4 W	10015-147	Ref
A10R63		Res, met flm, 221 Ω 1% 1/4 W	10015-197	2
A10R64		Res, met flm, 221 Ω 1% 1/4 W	10015-197	Ref
A10R65		Res, met flm, 215 Ω 1% 1/4 W	10015-169	3
A10R66		Res, met flm, 215 Ω 1% 1/4 W	10015-169	Ref
A10R67		Res, met flm, 215 Ω 1% 1/4 W	10015-169	Ref
A10R68		Res, met flm, 210 Ω 1% 1/4 W	10015-52	1
A10R69		Res, met flm, 205 Ω 1% 1/4 W	10015-196	3
A10R70		Res, met flm, 205 Ω 1% 1/4 W	10015-196	Ref
A10R71		Res, met flm, 205 Ω 1% 1/4 W	10015-196	Ref
A10R72		Res, met flm, 200 Ω 1% 1/4 W	10015-195	2
A10R73		Res, met flm, 200 Ω 1% 1/4 W	10015-195	Ref
A10R74		Res, met flm, 196 Ω 1% 1/4 W	10015-69	1
A10R75		Res, met flm, 191 Ω 1% 1/4 W	10015-194	3
A10R76		Res, met flm, 191 Ω 1% 1/4 W	10015-194	Ref
A10R77		Res, met flm, 191 Ω 1% 1/4 W	10015-194	Ref
A10R78		Res, met flm, 187 Ω 1% 1/4 W	10015-193	2
A10R79		Res, met flm, 187 Ω 1% 1/4 W	10015-193	Ref
A10R80		Res, met flm, 182 Ω 1% 1/4 W	10015-192	1
A10R81		Res, met flm, 232 Ω 1% 1/4 W	10015-198	2
A10R82		Res, met flm, 232 Ω 1% 1/4 W	10015-198	Ref
A10R83		Res, met flm, 237 Ω 1% 1/4 W	10015-199	2
A10R84		Res, met flm, 237 Ω 1% 1/4 W	10015-199	Ref
A10R85		Res, met flm, 243 Ω 1% 1/4 W	10015-200	2
A10R86		Res, met flm, 243 Ω 1% 1/4 W	10015-200	Ref
A10R87		Res, met flm, 249 Ω 1% 1/4 W	10015-46	2
A10R88		Res, met flm, 249 Ω 1% 1/4 W	10015-46	Ref
A10R89		Res, met flm, 255 Ω 1% 1/4 W	10015-44	3
A10R90		Res, met flm, 255 Ω 1% 1/4 W	10015-44	Ref
A10R91		Res, met flm, 255 Ω 1% 1/4 W	10015-44	Ref
A10R92		Res, met flm, 261 Ω 1% 1/4 W	10015-83	1
A10R93		Res, met flm, 267 Ω 1% 1/4 W	10015-201	2

REPLACEABLE PARTS LIST

REF. DESIG.	LOCA-TION	DESCRIPTION	HP PART NO.	TOT. QTY.
A10R94		Res, met flm, 267 Ω 1% 1/4 W	10015-201	Ref
A10R95		Res, met flm, 274 Ω 1% 1/4 W	10015-202	3
A10R96		Res, met flm, 274 Ω 1% 1/4 W	10015-202	Ref
A10R97		Res, met flm, 274 Ω 1% 1/4 W	10015-202	Ref
A10R98		Res, met flm, 280 Ω 1% 1/4 W	10015-203	2
A10R99		Res, met flm, 280 Ω 1% 1/4 W	10015-203	Ref
A10R100		Res, met flm, 287 Ω 1% 1/4 W	10015-204	1
A10S1		Switch, Rotary 3P20T	12021	1

ASSEMBLY 12088
REFERENCE DESIGNATORS ARE ABBREVIATED
PREFIX WITH A10

CAL FACTOR - dB



NOTE
UNLESS OTHERWISE SPECIFIED, RESISTOR VALUES ARE IN OHMS AND ARE ±1% ¼ WATT.

LIST OF MATERIAL

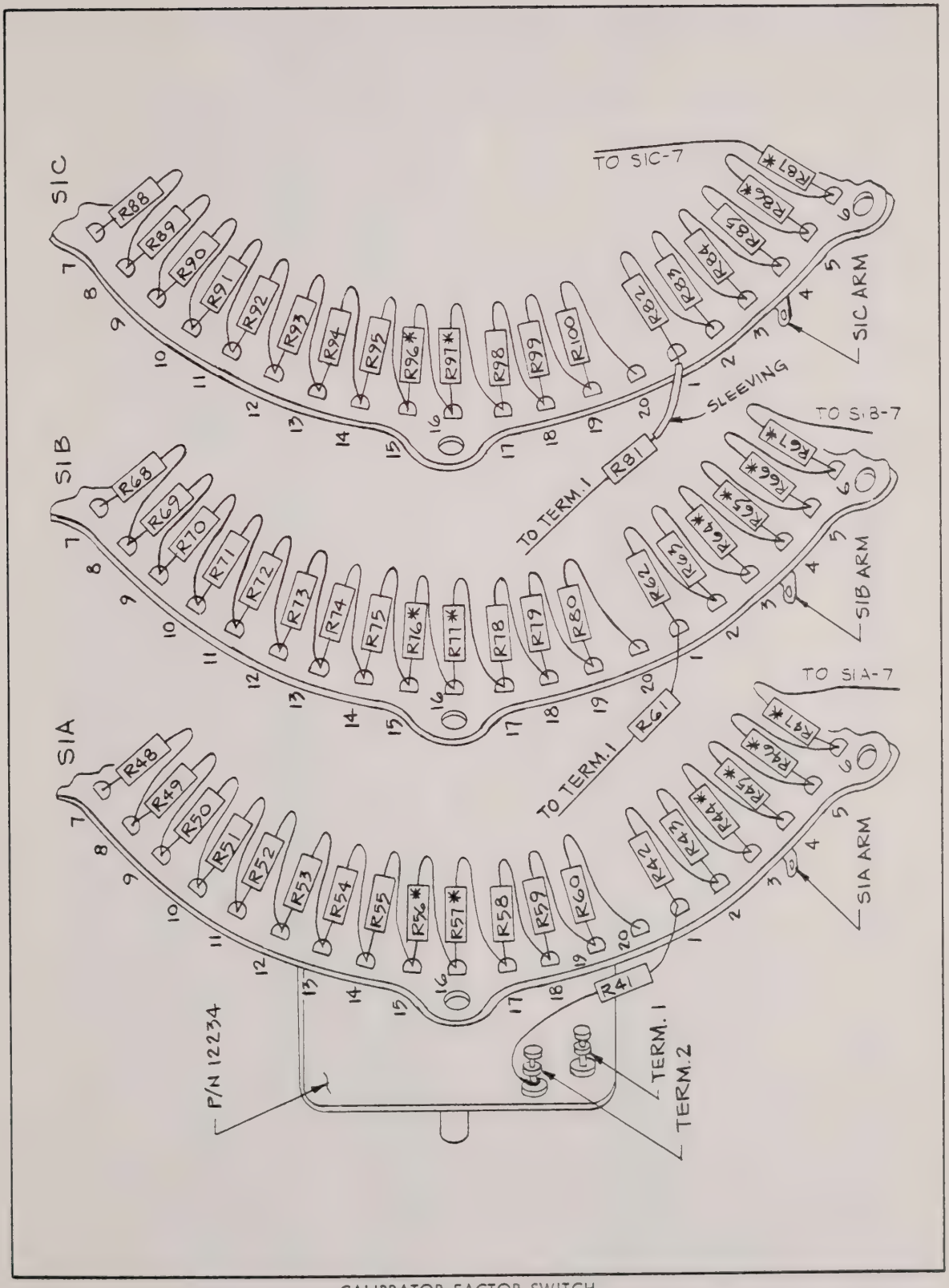
NEXT ASSY

PACIFIC MEASUREMENTS INCORPORATED

CAL FACTOR SWITCHING

DRAWING NO 12089

SHEET 1 OF 1



CALIBRATOR FACTOR SWITCH

FIGURE 7-15

PART NO. CROSS REFERENCE		
PM PART NO.	MFGR. CODE	MFGR. PART NO.
10000-1	56289	5GA-T10
10000-2	56289	5GA-T22
10000-3	56289	5GA-T47
10000-4	56289	5GA-D10
10000-5	56289	5GA-D22
10000-6	56289	5GAB-D47
10000-7	56289	5GAS-S10
10000-10	91418	Type TA 0.1 µF
10000-11	72982	805-000-X5V0-103Z
10000-12	56289	5GA-T15
10001-2	56289	10TCC-V47
10001-3	56289	10TCC-Q10
10001-4	56289	10TCC-Q22
10001-5	56289	10TCC-Q33
10001-6	56289	10TCC-Q47
10001-7	52689	10TCC-T10
10001-9	56289	10TCC-V68
10001-12	56289	10TCC-V33
10001-14	56289	10TCC-Q68
10001-15	56289	10TCC-T15
10003-1	56289	TVA-1208
10003-2	56289	39D108G025GL4
10003-3	12674	EMW-2468
10003-4	56289	TVA-1608
10007-1	01002	75F1R2A 102
10007-5	01002	75F1R2A 223
10007-6	01002	75F1R2A 473
10007-7	01002	75F1R2A 104
10007-8	01002	75F1R2A 224
10011-1	27556	ZA2060K 10%
10013-1	73445	B803104NB 100
10013-5	73445	B803104NB 220
10013-7	73445	B803104NB 330
10013-9	73445	B803104NB 470
10013-11	73445	B803104NB 680
10013-13	73445	B803104NB 101
10013-17	73445	B803104NB 221
10013-19	73445	B803104NB 331
10013-21	73445	B803104NB 471
10013-23	73445	B803104NB 681
10013-25	73445	B803104NB 102
10013-27	73445	B803104NB 152
10013-29	73445	B803104NB 222
10013-31	73445	B803104NB 332
10013-33	73445	B803104NB 472
10013-35	73445	B803104NB 682
10013-37	73445	B803104NB 103
10013-39	73445	B803104NB 153
10013-41	73445	B803104NB 223

PART NO. CROSS REFERENCE		
PM PART NO.	MFGR. CODE	MFGR. PART NO.
10013-41	73445	B803104NB 223
10013-43	73445	B803104NB 333
10013-45	73445	B803104NB 473
10013-47	73445	B803104NB 683
10013-49	73445	B803104NB 104
10013-51	73445	B803104NB 154
10013-53	73445	B803104NB 224
10013-57	73445	B803104NB 474
10013-59	73445	B803104NB 684
10013-61	73445	B803104NB 105
10013-63	01121	CB1555
10013-68	01121	CB3955
10013-69	01121	CB4755
10013-73	01121	CB1065
10013-74	01121	CB2055
10015-1	01295	RN55D, 1.54K 1%
10015-3	01295	RN55D, 49.9 Ω 1%
10015-5	01295	RN55D, 215 KΩ 1%
10015-6	01295	RN55D, 464 KΩ 1%
10015-7	01295	RN55D, 10.0 KΩ 1%
10015-8	01295	RN55D, 10.5 KΩ 1%
10015-9	01295	RN55D, 17.8 KΩ 1%
10015-10	01295	RN55D, 14.7 KΩ 1%
10015-11	01295	RN55D, 16.2 KΩ 1%
10015-13	01295	RN55D, 100 KΩ 1%
10015-14	01295	RN55D, 31.6 KΩ 1%
10015-15	01295	RN55D, 21.5 KΩ 1%
10015-19	01295	RN55D, 1.00 KΩ 1%
10015-20	01295	RN55D, 1.10 KΩ 1%
10015-24	01295	RN55D, 46.4 KΩ 1%
10015-25	01295	RN55D, 61.9 KΩ 1%
10015-26	01295	RN55D, 154 KΩ 1%
10015-29	01295	RN55D, 422 Ω 1%
10015-30	01295	RN55D, 7.68 KΩ 1%
10015-41	01295	RN55D, 48.7 KΩ 1%
10015-43	01295	RN55D, 121 KΩ 1%
10015-44	01295	RN55D, 255 Ω 1%
10015-45	01295	RN55D, 499 KΩ 1%
10015-46	01295	RN55D, 249 Ω 1%
10015-48	01295	RN55D, 27.4 KΩ 1%
10015-50	01295	RN55D, 1.47 KΩ 1%
10015-52	01295	RN55D, 210 Ω 1%
10015-54	01295	RN55D, 110 KΩ 1%
10015-57	01295	RN55D, 8.66 KΩ 1%
10015-59	01295	RN55D, 10.5 KΩ 1%
10015-60	01295	RN55D, 19.6 KΩ 1%
10015-61	01295	RN55D, 39.2 KΩ 1%
10015-62	01295	RN55D, 200 KΩ 1%
10015-63	01295	RN55D, 402 KΩ 1%
10015-65	01295	RN55D, 4.99 KΩ 1%
10015-66	01295	RN55D, 9.53 KΩ 1%
10015-67	01295	RN55D, 143 KΩ 1%
10015-68	01295	RN55D, 100 Ω 1%
10015-69	01295	RN55D, 196 Ω 1%

PART NO. CROSS REFERENCE		
HP PART NO.	MFGR. CODE	MFGR. PART NO.
10015-70	01295	RN55D, 681 Ω 1%
10015-71	01295	RN55D, 909 Ω 1%
10015-72	01295	RN55D, 1.96 KΩ 1%
10015-74	01295	RN55D, 2.00 KΩ 1%
10015-78	01295	RN55D, 2.26 KΩ 1%
10015-80	01295	RN55D, 4.02 KΩ 1%
10015-81	01295	RN55D, 11.3 KΩ 1%
10015-83	01295	RN55D, 261 Ω 1%
* 10015-85	01295	RN55D, 287 KΩ 1%
10015-88	01295	RN55D, 27.4 Ω 1%
10015-91	01295	RN55D, 90.9 KΩ 1%
10015-95	01295	RN55D, 29.4 KΩ 1%
10015-104	01295	RN55D, 5.62 KΩ 1%
10015-105	01295	RN55D, 6.19 KΩ 1%
10015-106	01295	RN55D, 6.81 KΩ 1%
10015-108	01295	RN55D, 191 KΩ 1%
10015-113	01295	RN55D, 75.0 Ω 1%
10015-116	01295	RN55D, 30.1 KΩ 1%
10015-120	01295	RN55D, 69.8 KΩ 1%
10015-128	01295	RN55D, 43.2 Ω 1%
10015-132	01295	RN55D, 825 Ω 1%
10015-133	01295	RN55D, 49.9 KΩ 1%
10015-137	01295	RN55D, 39.2 Ω 1%
10015-139	01295	RN55D, 133 Ω 1%
10015-145	01295	RN55D, 127 Ω 1%
10015-146	01295	RN55D, 162 Ω 1%
10015-147	01295	RN55D, 226 Ω 1%
10015-148	01295	RN55D, 11.5 Ω 1%
10015-149	01295	RN55D, 16.9 Ω 1%
10015-150	01295	RN55D, 46.4 Ω 1%
10015-151	01295	RN55D, 59.0 Ω 1%
10015-154	01295	RN55D, 806 Ω 1%
10015-155	01295	RN55D, 169 Ω 1%
10015-169	01295	RN55D, 215 Ω 1%
10015-176	01295	RN55D, 3.48 KΩ 1%
10015-192	01295	RN55D, 182 Ω 1%
10015-193	01295	RN55D, 187 Ω 1%
10015-194	01295	RN55D, 191 Ω 1%
10015-195	01295	RN55D, 200 Ω 1%
10015-196	01295	RN55D, 205 Ω 1%
10015-197	01295	RN55D, 221 Ω 1%
10015-198	01295	RN55D, 232 Ω 1%
10015-199	01295	RN55D, 237 Ω 1%
10015-200	01295	RN55D, 243 Ω 1%
10015-201	01295	RN55D, 267 Ω 1%
10015-202	01295	RN55D, 274 Ω 1%
10015-203	01295	RN55D, 280 Ω 1%
10015-204	01295	RN55D, 287 Ω 1%
* 10015-87	01295	RN55D, 15.0 KΩ 1%
10017	07263	2N3569
10018	07263	2N3646
10019	07263	2N3565
10020	02735	40250
10021	07263	2N3563
10023	07263	2N3644

PART NO. CROSS REFERENCE		
HP PART NO.	MFGR. CODE	MFGR. PART NO.
10043	09214	1N4148
10044-1	11711	1N4383
10044-2	11711	1N4385
10045	07910	1N823
10046-1	71450	X201R501B
10046-2	71450	X201R203B
10046-3	71450	X201R503B
10046-4	71450	X201R502B
10046-5	71450	X201R202B
10046-6	71450	X201R201B
10046-7	71450	X201R102B
10046-8	71450	X201R103B
10046-9	71450	X201R101B
10046-10	71450	X201R104B
10046-13	71450	X201R105B
10048	02660	31-221-1050
10050-1	02660	225-21513-101
10052	82389	AC3G
10053	70903	17258
10054-1	74970	105752
10054-2	74970	105753
10054-3	74970	105760
10057	09353	7201
10058	82389	Series 913
10064-2	75915	312.500
10095-3	71450	Series 45, 1.5 KΩ
10095-4	71450	Series 45, 10 KΩ
10133-3	00656	Type CN, NPO 1.0 pF
10140-1	74970	105852
10140-2	74970	105857
10140-3	74970	105853
10142-2	01121	CB1565
10142-4	01121	CB2265
10206	07263	2N3053
10209	90634	51RD21
10217	28821	10217
10312	07263	2N2917
10325	28821	10325
10339	07263	2N4360
10398	07263	2N4121
10416	28821	10406
10450	76854	399163-184
10630-1	72982	538-011-89A
10631-2	99800	1025-50
10677-3	84171	DM19F252J-500V-4CR
10677-16	84171	DM15F430J-500V-4CR
10182	02114	56-59065/3B

PART NO. CROSS REFERENCE		
HP PART NO.	MFGR. CODE	MFGR. PART NO.
10722-1	04713	MC724P
10722-2	04713	MC725P
10722-3	04713	MC788P
10722-4	04713	MC789P
10722-5	04713	MC790P
10722-6	04713	MC792 P
10723	83594	B-5441
10724	83594	B-5442
10725-1	22045	J110,4.00KΩ 0.05%
10725-2	22045	J110,5.00KΩ 0.05%
10725-4	22045	J110,17.555KΩ 0.05%
10725-5	22045	J110,142.20KΩ 0.05%
10725-7	22045	J110,158.00KΩ 0.05%
10725-8	22045	J110,15.80KΩ 0.05%
10725-9	22045	J110,3.996KΩ 0.05%
10726-1	14298	EE1/8-C3,10.000KΩ 0.1%
10726-2	14298	EE1/8-C3,20.000KΩ 0.1%
10727-1	14298	EE1/8-C2 40KΩ 0.5%
10727-2	14298	EE1/8-C2 50KΩ 0.5%
10728	07263	U68996079
10743	04713	MC1709CL
10765	83594	SK-196
10769	04713	MC1709CG
10786	02735	2N5184
10787-1	56289	196D475X0035JA1
10787-2	12954	D12GSB20M
10787-3	12954	D27GSB15M
10787-4	12954	D68GSC15M
10787-5	56289	196D105X0035HA1
10787-6	12954	D2R7GSA15M
10787-8	56289	196D474X0035HA1
10787-10	56289	196D107X0020MA3
10791	28821	10791
10803-1	94144	DS70-1BD-2G
10804-1	94144	DS70B-3-2G
10811	28821	10811
10841-2	28821	10841-2
10896	02735	3N138
10978-1	00779	583527-1
10978-2	00779	583529-1
11104	28821	11104
11116	02735	CA3030
11118	02735	CA3039
11119	07263	2N4250
11160	82389	46256LF
11177	28821	11177
11207	28480	0727-1033
11230	07263	U5B7710393
11270-3	01295	SN7420N
11270-24	01295	SN74121N

PART NO. CROSS REFERENCE		
HP PART NO.	MFGR. CODE	MFGR. PART NO.
11303	02735	40389
11345	28480	HPA 2900
11385	00303	Style BEPB
11386-1	00303	WBL
11386-2	00303	RBL
11387-1	00303	#75
11387-2	00303	#11
11432	27014	FM3955
11433	02735	2N3440
11434	04713	1N5276B
11457	28821	11457
11485-13	14298	REA C-2, 63.00 KΩ 0.1%
11485-16	14298	REA C-2, 53.27 Ω 0.1%
11485-17	14298	REA C-2, 790 Ω 0.1%
11499-1	71450	340PC102B
11504	28821	11504
11518-1	14298	Style CE 1/8
11536	28821	11536
11539	07263	U5B7741393
11507	01295	TIS97
11508	28821	11508
11683	28821	11683
11688-1	71450	B-185-HT-104-B
11690	27014	LM302H
11692	07263	2N5833
11711-2	73138	Series 66W, 100 KΩ
11730	91929	22SM723-T2
11856	71400	Type HMB
11962	01961	P.E. 5784
12021	28821	12021
12024	72982	1202-052
12025-1	72982	Type 669-013, 24 pF
12025-2	72982	Type 669-013, 56 pF
12026	28821	12026
12027	28821	12027
12111	28821	12111
12132	28821	12132
12134	01961	PE #5761
12135	28821	12135
12159	02735	2N4427
12163-2	28821	12163-2
12166	28821	12166
12205	28821	12205
12217	28821	12217
12497-1	28821	12497-1
12591	17856	E112

FEDERAL SUPPLY CODE FOR MANUFACTURERS

The following five-digit code numbers are listed in numerical sequence along with the manufacturer's name and address to which the code has been assigned.

The Federal Supply Code has been taken from Cataloging Handbook H 4-2, Code to Name.

00303	Shelly Associates Inc. El Segundo, California.
00656	Aerovox Corp. New Bedford, Massachusetts
00779	AMP Inc. Harrisburg, Pennsylvania
01002	General Electric Co. Capacitor Dept. Hudson Falls, New York
01121	Allen-Bradley Co. Milwaukee, Wisconsin
01295	Texas Instruments, Inc. Semiconductor Components Div. Dallas, Texas
01961 *	Pulse Engineering Inc. Santa Clara, California
02660	Amphenol-Borg Elect. Corp. Broadview, Illinois
02735	Radio Corp. of America Semiconductor and Materials Div. Somerville, New Jersey
04713	Motorola, Inc. Semiconductor Products Div. Phoenix, Arizona
07263	Fairchild Camera and Inst. Corp. Semiconductor Div. Mountain View, California
07910	Continental Device Corp. Hawthorne, California
09214	General Electric Co. Semiconductor Products Dept. Auburn, New York
09353	C and K Components Inc. Newton, Massachusetts
11711	General Instruments Inc. Semiconductor Div. Newark, New Jersey
12674	Syncro Corp. Hicksville, Ohio
12954	Dickson Electronics Corp. Scottsdale, Arizona
14298	American Components, Inc. Conshohocken, Pennsylvania
27014	National Semiconductor Corp. Santa Clara, California
27556	IMB Electronic Products Santa Fe Springs, California
28480	Hewlett-Packard Co. Palo Alto, California
28821	Pacific Measurements Inc. Palo Alto, California
56289	Sprague Electric Co. North Adams, Massachusetts
70903	Belden Mfg. Co. Chicago, Illinois
71400	Bussman Mfg. Div. of McGraw-Edison Co. St. Louis, Missouri
71450	CTS Corp. Elkhart, Indiana
72982	Erie Tech. Products Inc. Erie, Pennsylvania
73138	Beckman Instruments Inc. Helipot Division Fullerton, California
73445	Amperex Electronic Corp. Hicksville, New York
74970	E. F. Johnson Co. Waseca, Minnesota
75915	Littlefuse Inc. Des Plaines, Illinois
76854	Oak Mfg. Co. Crystal Lake, Illinois
82389	Switchcraft Inc. Chicago, Illinois
83594	Burroughs Corp. Electronic Components Div. Plainfield, New Jersey
84171	Arco Electronics Inc. Great Neck, New York

90634	Gulton Industries Inc. Metuchen, New Jersey
*75042	International Resistance Co. Philadelphia, PA.
*22045	Jordan Electric Van Nuys, Calif.
94144	Raytheon Co. Components Div. Quincy, Massachusetts
99800	Delavan Electronics Corp. East Aurora, New York.
*02114	Ferroxcube Corp. of America Saugerties, New York

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